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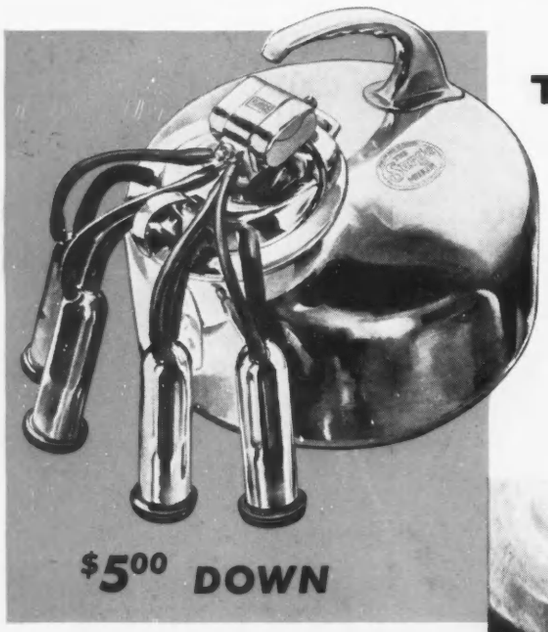

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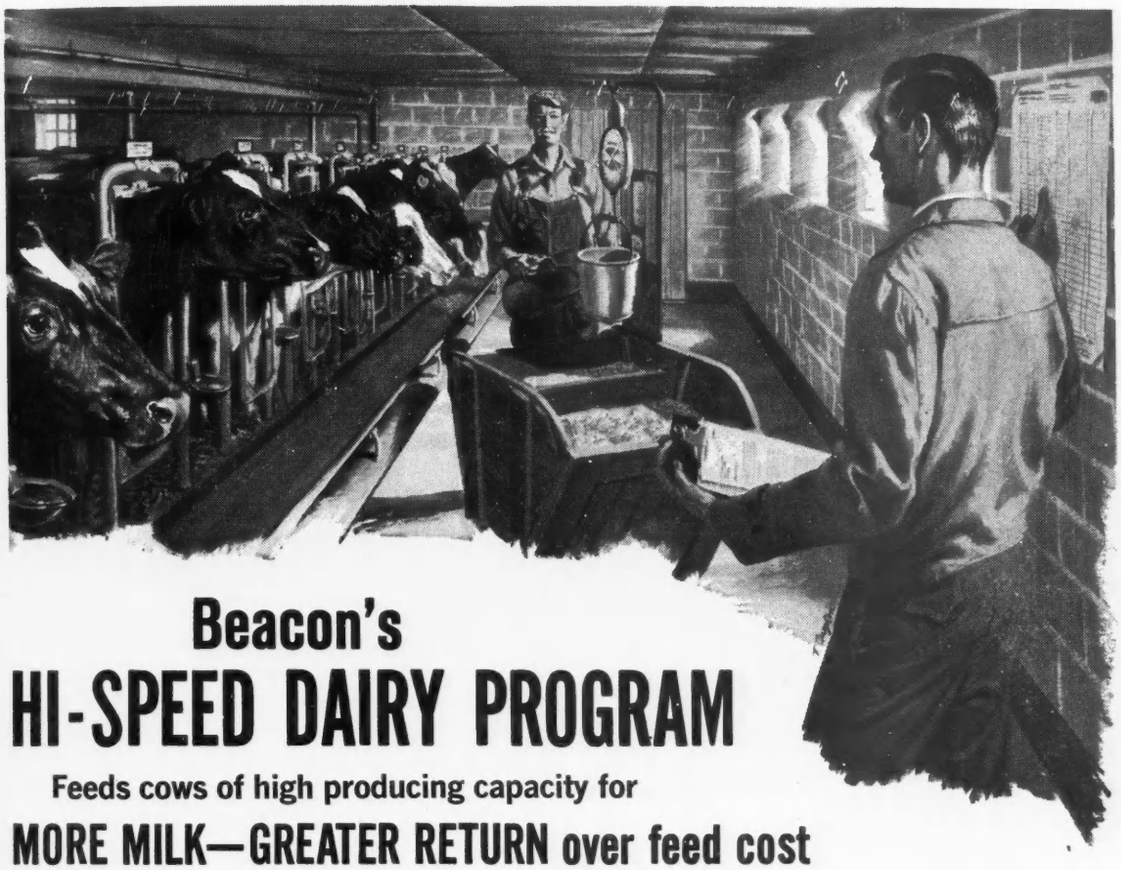

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Cover—Research is the theme of Farm and Home Week. This month's cover symbolizes the continuous research that is going on at Cornell, year after year. For a glimpse of the many kinds of research that are going on, turn to page 21 "Scientific Agriculture, 1970." Cover artist: Louise H. Burmester, '60.

The Cornell Countryman is published monthly from October through May by students in the New York State Colleges of Agriculture and Home Economics, units of the State University of New York, at Cornell University. Entered as second-class matter, postage paid at Ithaca, New York and at additional mailing offices. Printing by Norton Printing Co. of Ithaca. Subscription rate is $1.75 a year or two years for $3.25; three years for $4.50; single copies, 25 cents.

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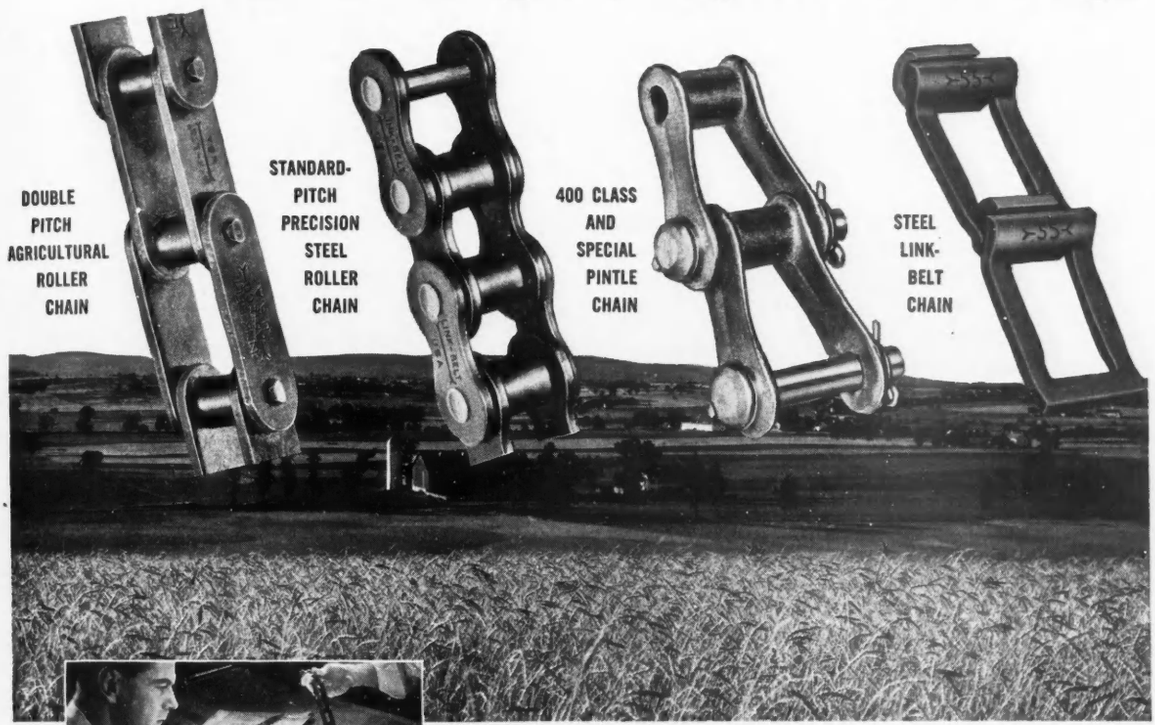
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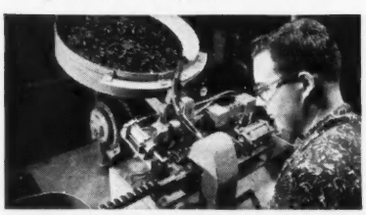

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Editorial

The Rewards of Research

FARM and Home Week gives many people—the visiting public, students and the faculty—a chance to get a glimpse of the incredible scope of activities carried on in the Colleges of Agriculture and Home Economics. When you are caught in your daily routine of classes, studying and coffee breaks there is a tendency to forget why Cornell has such a prominent national and international reputation. The displays and lectures of Farm and Home Week give a compressed idea of the activity that goes on the year around at Cornell.

But no display can give the entire picture of the unending scientific investigation at Cornell. Research is a singularly unglamorous occupation. Few of the discoveries and advances made at Cornell were accidents. They are the result of careful planning, carefully controlled experiments and painstaking, time-consuming analysis.

Some of the most important experimental work in hybrid corn was done in a dusty little hollow in back of Fernow Hall. This hollow is now known as the Emerson Garden, after R. A. Emerson who played a major part in developing the world's hybrid corn.

Corn is still grown and bred in the Emerson Garden. Drop by in the summer if you want to see what research is really like. Each corn plant is neatly capped with a brown paper bag. Half-way through the season the bags are bleached white from the hot summer sun. Even when there is a breeze, it is sweltering between the rows from the heat and the transpiration. But, every day the researcher and his graduate assistants move through the rows, transferring the paper bags from the tassels to the ears. After a while you get used to breathing pollen all day long.

At the end of the summer, the work isn't over. The seed has to be removed from the ears, it has to be dried, it has to be classified and labeled so that it can be planted again next year.

Eventually, you get what you have been looking for—a variety that has strong stalks, high yield and is disease resistant. The variety gets printed up in *Cornell Recommends,* the farmers like it and plant it heavily. Your work has paid off.

The next year a new corn smut invades New York and begins to destroy the corn crop. You go back to the experimental plots and start over again.

The scene is not always the experimental plots. Sometimes it is the lab, or the barn, or the greenhouse. You are working with protozoa, or cattle, or hormones. But the cycle is similar—long hours of hard work and then the occasional reward of knowing that you are making nature just a little bit less mysterious.

THE March issue is the last one for this writer. This is my public thanks to the staff-members for the time and effort they've put into the magazine.

Ed Razinsky, '61 and Al Burg '63 have just been elected Editor-in-Chief and Business Manager, respectively. My best wishes for success go to them as the Countryman begins its 57th year of continuous publication.

Zilch Stays, The Rest Go

ZILCH again this year, notes with pleasure the advent of Cornell's very own Farm and Home Week. He is enthralled with the prospect of having so many people descend on this fair campus and, perchance, read these humble words on the pages of the Countryman.

This time of year also marks a milestone for many of the champions of the written word who unselfishly contribute both time and talent to the Countryman. This milestone comes in the form of staff elections, and with these elections our ranks are broken and/or reorganized.

Traditionally, the Editor-in-Chief writes a last will and testament as his editorial, in which he leaves various items to out-going staff, friends, and well-wishers. Since the present editor has taken it upon himself to brazenly and wantonly stray from custom, Zilch feels that it is his duty to shoulder this responsibility and carry on this noble gesture. Herein will follow the Zilch version of the time-honored testament.

To the Editor-in-Chief: (most high and sainted) To him goes the Agriculture and Home Economics Inter-College Public Relations Award given to the student most likely to be knifed in Martha Van. To him also goes a Sears, Roebuck gift certificate for one pair of $4.95 sneakers.

Business Manager: A copy of the text, "How to Make Small Advertisers Into Big Spenders." It has been suggested that this personage lacks certain facial features which may be considered pleasant to the human eye. To help him overcome this deficiency, Zilch gives him a five pound glob of modeling clay and the book, "Plastic Surgery for the Micro-cephalic."

Managing Editor: To him, Zilch's rules for calculated copy fitting, the Certificate of Merit from the National Rubber Cement Institute, and the extension bulletin called, "Rabbit Care and Handling."

Associate Editors: For her—the bent pica stick and the remainder of the cropping wheel. For him: the names and addresses of the roommates of all the girls on the staff.

Photo Editor: Formal and informal poses of all the professors in the Ag School. It is hard for him to take good pictures because his camera is so small. He can't get a bigger camera because his VW wouldn't hold it.

Home Ec. Editor: To her, an appointment with all the Home Ec. professors and their promise to disclose all, withhold nothing.

Board of Directors: Ah, sweet symbols of stability! For them, a clause in the constitution which limits their term in office to no more than 20 years.

To the Countryman Staff: Zilch says to you that, if elected to the office of Editor-in-chief, he will give by-lines to the business staff, and article payment to the writers!

Vis Aids people: In honor of your leader; one pocket knife, an Alnico 5 magnet, four pieces of Alphacite chalk (should be a life-time supply), and 72 pounds of warm Glycowax.

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Deane W Malott, President of Cornell University

From the President's Desk

On behalf of Cornell University I wecome you to the campus; we are happy to have you with us for the annual observance of Farm and Home Week.

Your colleges at Cornell, the New York State Colleges of Agriculture, Home Economics, and Veterinary Medicine, plan this diverse program each year to aid you in your goal — improving your farms and homes — so that you can serve better the ever growing population of our country and the world. In a sense we have a common goal. Whatever you learn here, whatever ideas for improvement you take home with you, benefit us all.

Through the lectures, exhibits and events planned for you during this period, you can share in the discoveries made here and in the current research being conducted by Cornell University for you.

We hope you participate fully in the program, profit from it and come back again soon. You are always most welcome.

Deane W. Malott

President, Cornell University

Forty Years Ago . . .

. . . a new farm organization bearing the cumbersome name of Cooperative Grange League Federation Exchange set out to implement the recommendations of the Cornell College of Agriculture.

Working with Cornell specialists, G.L.F. (as is was to be more familiarly known) was able to turn those recommendations into reality, making available to New York State farmers such innovations as open formula feeds and fertilizers, and known-origin seeds adapted to rigorous Northeast weather.

From a handful of farm leaders and an idea, G.L.F. has grown in four decades into a 118,000-member farmers' cooperative serving New York, New Jersey and northern Pennsylvania.

Much of the inspiration for G.L.F.'s founding came from agricultural pioneers at Cornell. Their work and the work of their successors have contributed greatly to the success and growth of G.L.F.

On this, our Fortieth Anniversary, we look forward to the next forty years of cooperation between our two institutions, in the interests of a more prosperous agriculture.

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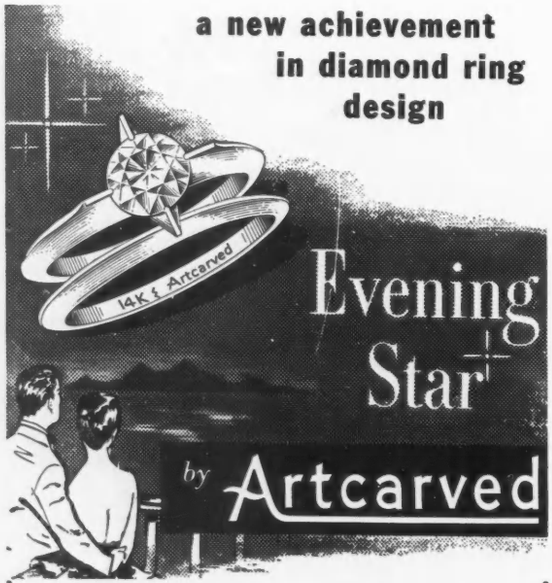

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We're Happ To

WELCOME to the new Farm and Home Week!

We have streamlined the agricultural part of this 49th annual event. In compressing the former five days into three, we hope you will find the 1960 program with its theme, "The Challenge of Change," not only more compact and better coordinated, but also an easier one to select and attend the many events of your choice. This includes not only the lectures but the centralized exhibits and demonstrations as well. For the first time, the rural youth will have a program of their own.

Although Farm and Home Week has a "new look," basically it has the same purpose of helping the people of New York State to live better now and to plan for the future. In this big "open house," our scientists open up their laboratories and present new research.

This year, in particular, we are taking a look into the future of agriculture. What will dairying be like in 1970? What changes can farmers expect in marketing milk, poultry, fruits and vegetables, and other products? How will the population explosion affect agricultural markets and education? What can research do to help solve the problems of contamination in food supplies? What are the opportunities for young people in agricultural science? What will America and the world of 10 to 20 years hence be like? Scores of other important topics may be of special interest to you.

Farm and Home Week is one of the functions of the College of Agriculture designed to serve all the people of the State, including farmers, their organizations, city and suburban people, industries allied with agriculture, and others who depend directly or indirectly upon agriculture. It's a good time and place to study the present and to peer into the future. We're happy to have you as our guest, and we hope you find your visit a very profitable and enjoyable experience.

Helen G. Canoyer
Dean,
College of
Home Economics

To Have You

CHANGE is our way of life. However, during the past decade economic and social changes have come more quickly than ever before. In the 1960's, we can expect even more rapid and striking changes which will affect everything we do and think.

Change is a challenge, and this year's Farm and Home Week program is designed to help families gain insight into today's and tomorrow's changes and adjust to them. The staff of the College of Home Economics welcomes this opportunity to share information and exchange ideas with you. Each department offers the resources of its faculty and laboratories to help homemakers and their families understand rapidly changing conditions and make the increasingly complex choices that lie ahead.

You will have a chance to hear and think about what's happening now and what's just around the corner. As well as hearing results of research, you may see some of the research methods used to explore the unknown. You may widen your horizon by attending regular class sessions and hearing illustrated reports of recent travel in other countries.

You will get new ideas, gather facts, weigh alternatives, learn about new products and the skills required to handle these products satisfactorily. All this can help you as you perform your many roles—as informed citizens, community leaders, family members, and consumers. It's up to you to make the most of your visit.

WELCOME

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A researcher replaces a flask filled with coconut milk and gr owing carrot cells.

Dr. Steward's Pampered Plant Cells

Botanist F. C. Steward is studying unusual growth substances which cause a single carrot cell to develop into an entire plant. The National Cancer Institute is interested in his results.

by Jane E. Brody '62

DR. F. C. Steward of Cornell's department of botany has been able to stimulate a single, mature cell of a carrot so that it reproduces a new, fully-developed plant. This unusual proliferation of cells, which occurs rapidly and irregularly, is stimulated by growth factors contained in coconut milk.

The wild, erratic growth of these carrot cells is similar to what occurs in animals when certain cells suddenly deviate from their normal growth pattern and go haywire, producing cancerous tissue. Its direct relation to cancer, about which scientists know so little at present, is evidenced by the fact that the National Cancer Institute is supporting the research.

The mature, non-dividing cells of carrot root-phloem have been used most extensively in these experiments. Two milligram plugs of this tissue are removed from the carrot asceptically and placed in large round flasks which have nipples blown symmetrically about their circumference.

A base medium, and coconut milk extract are added to the flasks. The base medium allows some growth by cell enlargement. The coconut milk encourages fast growth of the tissue. The researcher then places them sideways on a large disk which rotates at a constant rate of 1 rpm. As the disk revolves, each nipple containing the explanted tissue is first submerged in the growth medium and then exposed to air. The entire experiment is carried out under controlled conditions of light and temperature.

In this system, the 2 mg. explants grow rapidly and uniformly, increasing in weight to as much as 10 mg. in about 28 days. It appears that the coconut milk contains substances, distinct from any known vitamins or growth regulators, which are capable of stimulating cell division.

Free Floating Cells

Although the original 2 mg. plug

consists of many cells, the liquid medium in the flask contains many free-floating single cells which apparently break loose from the plug. Microscopic observation has revealed that these cells are alive and undergoing cell division. The free cells are then transferred to a new flask in which they grow freely, dividing to yield a multicellular mass.

4-Way Growth

Cells isolated from potato tuber and peanut cotyledon as well as from carrot phloem exhibit this accelerated growth which occurs in four different ways: "1) proliferation of an isodiametric 'mother' cell and colony formation by successive divisions, 2) internal divisions and formation of a moruloid mass within the confines of the original cell wall, 3) extrusion of tube-like or filamentous processes and formation of multicellular filaments, and 4) extrusion of small papillae or buds which enlarge into full grown cells."

It is not long before the resulting cell-aggregates, which strongly resemble embryo plants, commence to form root-like structures. When placed on a semisolid agar medium, the culture at this stage will develop a shoot, and then may produce a carrot storage root. And this completes the cycle from carrot root-phloem, to free cell, to carrot root, to carrot plant!

But this is far from the end of the story. What constituent of coconut milk stimulates the growth of cells which do not respond to "a number of commonly used nutrient extracts or plant-growth stimulants?" The active components of the coconut milk are separated by fractionation. Fractionation takes advantage of differences in the distribution ratios of substances in two immiscible liquids. Very similar substances can be separated by successive fractioning.

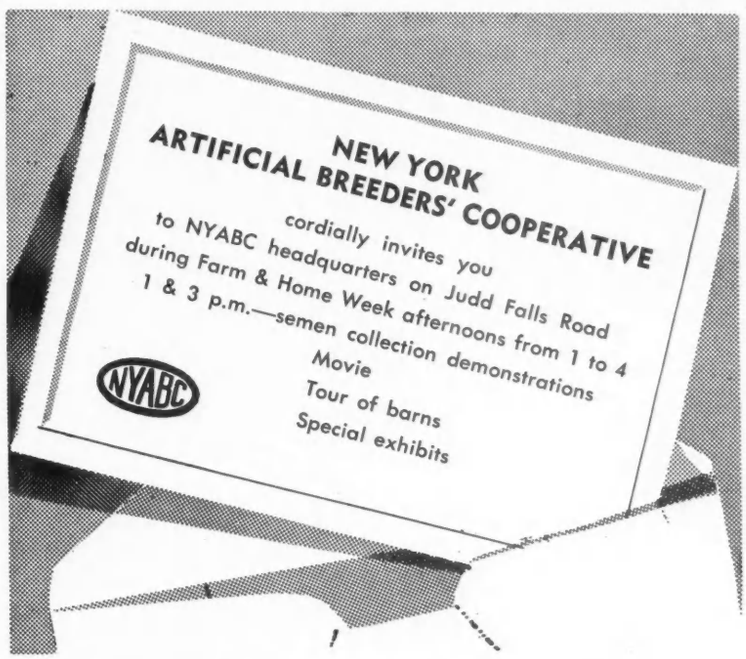
Fractions containing isolated or partially isolated substances must then be tested individually to see if they will incite cell growth. The coconut milk, which is really the liquid endosperm that nourishes the coconut embryo, has been found to contain not one but several active growth-promoting substances, at least three of which have been isolated in the form of recrystallized substances. No one of these substances that has thus far been tested has been able to stimulate growth by itself. Instead, a combination of two or more of these active components appears necessary to produce this unusual activity.

Scientific Implications

This experiment lends insight into many problems of the biochemical world. It can be viewed as an extensive study of cell division as a process essential to life. It is also an attempt to understand better the metabolism of growing tissue. It may reveal those substances present in the endosperm which are responsible for stimulating the rapid growth of an embryo plant.

It hints at the possibility of identifying and perhaps even synthesizing the substances which regulate cell division at least in plants. These substances may be found to have use in agriculture as herbicides or growth regulators.

But, as an ultimate goal, it is hoped that this work, which has been in progress now for several years, will eventually shed some light upon what is responsible for the sudden, uncontrollable growth of cancerous tissue.



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By Monroe C. Babcock

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14. Gentle, easy bird to handle.
15. Customers who tried this new bird in 1959 couldn't find any faults in her.

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. . . to visit us at Babcock Poultry Farm during Cornell Farm and Home Week, March 22-24. We are located on Route 96, six miles northwest of Ithaca. It will help if you call before you come so we can have some one on hand to show you around.

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Buy Chicks By Test

Random sample egg laying tests can be an important tool for the nation's poultrymen. Here's how they work and how to use them as chick buying guides.

by Edward L. Razinsky '61

RANDOM sample egg laying tests may not mean any more as a chick buying guide than the color of the chick salesman's eyes. With almost every chick salesman reporting that his brand of bird ranks in the first quartile in at least one random sample test for some trait, the poultryman has reason to wonder if these tests really prove anything.

Dr. Dean R. Marble, professor of Poultry Husbandry at Cornell, says that random sample tests are reliably operated and the results of such tests can be used as a guide to buying chicks . . . if properly evaluated.

While discussing the random sample tests, Dr. Marble, who is the supervisor of the Western and Central New York tests and secretary-treasurer of the Council of American Official Poultry Tests, recalls that in the early days of poultry testing, the results were not always completely dependable.

The first "Standard" egg laying test (the testing procedures were standardized) was held in Storrs, Connecticut in 1912. The entries consisted of five pullets from each breeder.

Mature pullets were entered so it was possible for breeders to trapnest prior to the test and enter only their best birds. This was one big weakness of the old standards.

Dr. Marble also recalls the "horse race" atmosphere of the tests with all the breeders priming their entries for the big "race."

"As weak as the standard tests are," Dr. Marble states, "they have encouraged breed improvement." Today, there are only five standard tests left in the U.S. but they are still the primary type of poultry test in Europe.

A few years before the U.S. sank into the Great Depression of the

Dr. Marble suggests several points to consider when using random sample egg laying tests as chick-buying guides.

1. *Don't just look at one test.* See how the birds did in other tests in the country.

2. *One year's results are not enough.* If a breed does well consistently, year after year, in all tests, it will probably do well on your farm.

3. *Environment is important.* Some strains perform well under some conditions but poorly under others. Make sure you compare the testing conditions with those on your farm before you decide.

4. *Are the traits money-makers?* It's nice to be number 1, but it's better to be number 1 for a trait that will mean profit for the producer. (Egg production, livability and feed efficiency are most important.)

5. *Consider the ranking for traits that are important to you.* If you must sell extra large eggs for the same price as large, a high test score for percent extra large doesn't mean more profit for you.

6. *The test are a comparison—not a prediction.* The results show that X did better than Y, but NOT by how much.

7. *Check the publications of each test to judge differences.* Each test is different in some way—and this affects the value of the results. Know the test to judge the results.

8. *Study the overall test results.* The Council of American Official Poultry Tests publishes an annual bulletin which lists, by name, all the breeds in all the tests and how they did.

(A copy of the Council report may be obtained by writing to Dr. Dean R. Marble, Poultry Dept., Cornell University, Ithaca, N.Y. or your local test supervisor.)

The Central New York Random Sample Test at Horseheads, N. Y.

1930's, a change in poultry testing was made in the Netherlands. In these tests, larger numbers of entries from each breeder were picked at random and all the birds in the test were raised in one place. This led the way for the modern random sample tests of today.

Sunny California held the first of the modern random sample tests in the late 1940's. There are 14 random sample tests in operation in the U.S. today but, basically, their procedure is the same.

Any qualified breeder may enter his birds in any or all of the tests throughout the country by sending in his application and fee.

At a specified time the test supervisor or his representative (often the local county agent) goes to the breeders' farms to select hatching eggs for the test. They pick eggs, at random, from the incubator trays, cases of eggs on hand or the nests. (Dr. Marble does this for the Western and Central NYS tests.)

All the eggs from all the breeders in each test are hatched in the same way and at the same time. Of the chicks that hatch, 50-100 pullets are kept as the test flock.

Birds from the individual breeders are intermingled during brooding and rearing and are kept in identical conditions. The test runs until the birds are 500 days old and no culling may be done during the test.

Birds from each breeder are identified and records kept for the economically important traits. At the end of the test period, the results are figured out and each entry is given a score for each trait.

Because the difference between the top and bottom scores is often small, reports Dr. Marble, and because so many factors influence birds' performance, it wouldn't be fair or meaningful to call any one entry "number 1." For these reasons, entries are listed according to the score for each trait and the list is divided into quarters. In this way, no breed is "number 1," but only in the first quarter, or quartile. For comparison, all the birds in any quartile are considered equal.

Dr. Marble points out that the test results cannot be used to predict how many eggs a breed of chickens will lay. They only show if the breed did better, worse, or the same as the other entries in the test.

Random sample test results can be used as a good guide to buying chicks, concludes Dr. Marble, if they are taken for what they are worth—no more and no less.

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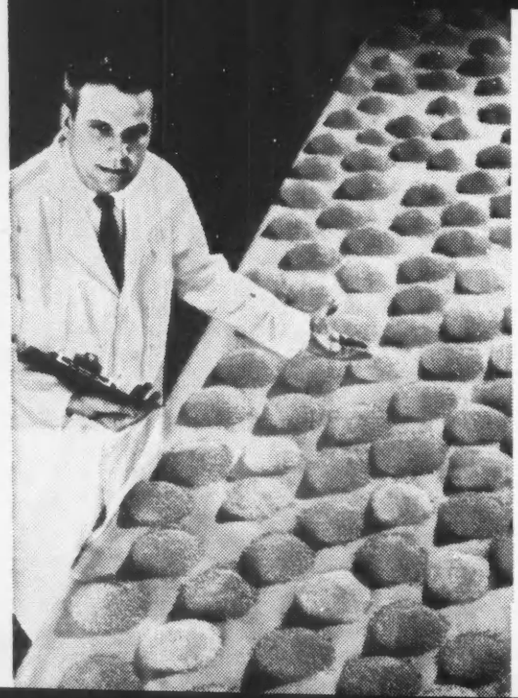

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Campus Flowers I Have Known

by Robert B. Gambino '61

WEEDS parties, picnics, gummies, bermuda shorts, field trips, and at last, sunlight are some of the signs many of us associate with spring at Cornell University.

During the month of April, we will see many other indications that warmer days are on their way. To some, the presence of robins and chipmunks indicate the coming of spring. To others, the real precursor of spring is the rejuvenation of plant growth.

All over campus and the surrounding countryside, leaf and flower buds will begin growth by bursting their inclosing scales. Perennial plants and bulbs, too, will poke their green shoots through the half thawed out Ithaca soil.

Probably, the first spring color will be noted on the corner of Tower Road and East Avenue. The slope of lawn from the Andrew D. White Museum has been planted with crocus.

What could be more refreshing than seeing splashes of purple or yellow on a green background after a visit with the Dean of Men (or Women)?

Before the crocus blooms, however, many other plants show their courage by flowering through the wet March snows. The first of these, Helleborus, flowers as early as January or February, and is found in the courts of Plant Science Building. Also in these courts and along Tower Road between the two campuses, the Winter Aconite and Snowdrop can be found blooming together. Both are less than three inches in height. The Winter Aconite has yellow flowers while the Snowdrop blossom is white.

As the season proceeds into April the Siberian Squill, Grape Hyacinth and Trout Lily make their appearance in all the campus gardens. (The Trout Lily can also be found growing wild all around Beebe Lake.) One may occasionally find the Glory of the Snow which is similar to the Siberian Squill. Another interesting spring flowering bulb is the Star of Bethlehem. Its flowers are starshaped and white with green stripes.

A trip up Tower Road bordering the White Museum, during the first part of April (preferably at 7:30 in the morning) will be well remembered. Anyone with an appreciation for beauty of a different sort will never forget the swaying of the Narcissus against the light green background of newly leaved trees set in the pink glow of an Ithaca sunrise.

Many varieties of tulips may be found in the campus gardens. The best display of the common types (Darwins, Breeders, and Cottage) can be found in an area most of us associate only with alumni and Homecoming—the Big Red Barn. On one side of the Barn and behind the Andrew D. White Museum are tulip beds. This garden is also planted to summer annuals, presenting a beautiful picture of floral color to visitors and returning graduates all season long.

To one side of the tulips is a formal garden, the Secret Garden, planted mainly to white flowers. White tulips are used exclusively and combine well with the light blue blossoms of the Periwinkle.

When you leave the tulip beds and continue east toward the Upper Campus you will descend a few timber and grass steps and find yourself in an area comprised of many ericaceous plants. The plant that will be in bloom during the fore part of April is the Korean Rhododendron. It is the first northern Azalea to flower, the purple flowers appearing before the leaves. The plantings here provide an interesting opportunity to observe sequence of bloom and subtle combinations of colors.

The Lua Minns Garden on the corner of Tower Road and Garden Avenue will probably provide its usual colorful spring display of perennials. However, it will end before it really begins, since the garden is to be moved to a new and better location in front of Plant Science Building.

—*Floriculture*

Early spring flowers (top to bottom) Snowdrops, Golden Daffodils, and Primroses.

Throughout the Cornell campus there will be found an abundance of trees and shrubs that indicate the coming of spring. The yellow flowers of the Carnelian Cherry, the red flowers of the Red Maple, the gold of the Forsythia and the purple of the Daphne can be found with little difficulty if one is observant. During late April some of the Magnolias and Japanese Cher-

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ries will show their color. They are followed closely by the dainty white flowers of the Shadbush and the rose-salmon blooms of the Flowering Quince.

Following Wee Stinky Creek from Sage Hall through its course between Willard Straight Hall and the Medical Clinic one will find another area that abounds with spring color from late April through the summer. This is the Rock Garden.

This is one of the most diversly planted rock gardens in the area. The small white flowers of Arabis and the purple of the Aubrietea are found profusely covering the outcropped rocks. Golden color from Basket of Gold Alyssum can be found in the background. Dutchman's Breeches and Bleedinghearts have been planted in the lower part

—*Floriculture*

Trillium, one of the rarest spring flowers on Campus.

of the garden to add to the spectacle of the many varieties of Primrose that are interspersed within the area. An occasional English Daisy and Pasque Flower may also be discovered along the banks of the fragrant brook. Brunnera (looks like an overgrown Forget-me-not) has run hog-wild in the lower reaches, while the shaded lower corner is covered with Lungwort. Violets too will be in flower as the season progresses, spreading their perfumed scent all along Wee Stinky Creek. Many other rock garden plants will bloom throughout the season and add to the effect of this garden.

So grab your gummies and best date and take a stroll through the campus some balmy April day and try to find the location of the only Trillium on the Upper Campus. Remember, look—don't pick!

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REPORTS and REPARTEE

SPRING, 1960

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—Simplicity

Fashion stylists from Simplicity travel all over the country presenting fashion shows in high schools. These shows promote both the use of Simplicity patterns and home sewing.

Careers for Women Only

Publicity and promotion for firms in foods and textiles offer challenging careers for women trained in home economics.

by Carole J. Wedner '61

On the bulletin board of the high school sewing room hangs a step by step picture description of how to put a zipper in a dress. These charts and many similar ones were received by a grateful teacher from an industrial firm.

The College of Home Economics at Cornell turns out many fine educators, but they are not all teaching in the schools of the country. Many companies are setting up educational departments which hire home economists to experiment and write material which will be helpful to the public.

The purpose is two-fold. First, product promotion leads companies to seek ways to present their goals without actually advertising them. Good will is also fostered. Miss Rajean M. Codish, director of Talon Company's Educational Services explains that a child who learns to enjoy sewing and becomes successful at it is a consumer of zippers, thread, snaps, buttons, etc. for a lifetime.

Jobs in this field are many and varied. Field representatives travel all over the country visiting schools, stores, distributors, and adult groups. Simplicity Pattern Company sends out both store and school fashion shows accompanied by a representative. The representative sets up the show, fits dresses to models, moderates, and then moves on to another area.

The home offices of the education departments have advisory committees made up of about six leading educators. The National Dairy Councils consists of high school teachers, a head of foods in a college and a health specialist. These people check the general program and material being issued by the department to see if it fulfills education's needs and is understandable.

Research laboratories are also maintained by these companies in connection with the education departments. General Foods maintains extensive laboratories where every idea thought up, every product, and every customer complaint is tested. Talon Zipper Company and Coats and Clark Company maintain sewing rooms where ideas for new and better uses of their products are born and tested.

Opportunities for home economists in this field are enormous. Many top positions require experience, but getting it can be as exciting as reaching the top.

Mrs. Wood of the Home Economics College placement office recommends magazine and newspaper work for an incalculable amount of experience for the girl who can be creative with words. Hired as a "girl Friday" or copy writer, a college graduate learns how to put fresh ideas across to her boss, the editor, and the public. Many a Cornell graduate has found a job on one of the Fairchild Publications (*Woman's Wear Daily, Home Furnishings Daily*), gone on to a fashion magazine, and then into promotion.

Research work in any field, explained Mrs. Wood, provides background for advancement in industrial education. Here a graduate learns to follow through the ideas of others, come up with some of her own, and produce them in workable, practical form.

Both Miss Codish of Talon and Miss Mary Gerard of Simplicity Pattern Company emphasize that experience in retailing or teaching is essential for anyone interested in being a field representative. A person traveling alone and making

contacts for a company needs to know the problems of the sales clerk and the teacher. This knowledge can only be gotten by holding their job for a while.

The field representative also needs the maturity and presence of mind to be able to cope with the numerous and unusual problems that arise. When one has the knowledge and maturity necessary, the job is a fascinating and rewarding one.

Retailing can also lead to other promotion jobs. One Cornell graduate who began as a saleswoman at Shumakers' wholesale house has been promotion director for the manufacturers of Pellon for four years.

Entries into magazine and TC work are presented by secretarial jobs. The placement office in the Home Ec. College gets many requests for students as secretaries and has histories of students who advanced directly into the promotion field from these jobs.

Many college graduates are hired to answer correspondence. Customer letters pour into these departments at a fast rate. Each is answered as quickly and well as possible. Efficiency, correctness, and originality shown in answering consumer letters can be recognized and lead to higher and better things.

Sorcia Brodsky, now involved with fashion and fabrics at Corticelli-Blending Company, was assigned to write a history of the company when she first came there. She traced the company back to its beginnings, finding connections with many small thread manufacturing firms, the origin of the kitten tangled in thread symbol, and many other interesting facts. This original push plus subsequent jobs well done helped her achieve her present position.

The educational material issued by food companies, co-operatives (like the National Dairy Council), equipment companies, textile findings companies, and home furnishings companies is aimed at the public in general. Pamphlets, charts, and instructions are written for schools, extension groups, housewives, shoppers, experienced and inexperienced cooks, and home sewers.

Company findings produce much helpful material for school sewing laboratories. Coats and Clark Company, for instance, publishes an eight page leaflet called "Stitch In Time." Each issue covers a different area of sewing as fully as possible. Such subjects as hems, grain, facings, and sewing with wash and wear fabrics have been recently covered.

J. H. Thorp Company, producers of upholstery and drapery fabrics, put out a booklet for home decorators on "The Interior Decorator and You."

Utility companies not only show homemakers how to use their equipment but are helpful in planning efficient household work areas.

Meal plans for both over and under weight people, and for good health are available for both home and school use.

The job of getting a company's product before the public eye may be called publicity, promotion or education. No matter what the title, it has created a need for home economists and provides many dynamic jobs for Cornell graduates.

—General Foods

Home Economist Audrey Jones '57 demonstrates a technique for Jacky Grimes and Mary Ann Roda. Helen Thackeray, Manager of General Foods Test Kitchens, makes an additional point.

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Scientific Agriculture, 1970

Agriculture is moving ahead at a tremendous rate. This progress is coming in every area of agricultural endeavor. The Countryman asked 11 College of Agriculture professors to predict the advances that will take place in their fields by 1970. The next 14 pages contain their thoughts. To lead off this special section, we have asked Farm and Home Week's keynote speaker, Dr. Earl L. Butz, Dean of Agriculture, Purdue University, to give us an overall outlook for agriculture in 1970.—Ed.

Outlook for the Decade

"A strong and growing agriculture"

Earl L. Butz,
Dean of Agr.,
Purdue University

THE rapid change which characterized agriculture in the 1950's will continue unabated through the 1960's. Farmers will use more capital per worker, more machinery, larger and more economical power units, less cultivation and more chemical weed and insect controls.

One worker on farms now feeds and clothes himself and 25 others. This ratio has trebled in the last generation. By 1970 fewer workers on our farms than now will be feeding 215 million Americans—37 million more than now. One farm worker will feed and clothe about 40 other people—better than ever before in history. When Mr. Khrushchev sees that, he may modify his oft-repeated boast about the Russian farmer overtaking the American farmer in per capita production of meat, milk, and eggs.

Only about 8 percent of our total population will be members of farm families in 1970. This contrasts with 11 percent now, and over 25 per cent a generation ago. By 1970, we'll have a fifth fewer farms than now, just as we now have about one fifth fewer than 10 years ago.

This decline in number of farms does not mean that agriculture is falling apart. Nothing is more erroneous than to think of agriculture as a declining industry. American agriculture is an expanding industry in every important respect except one—the number of people required to run our farms. Only in this single respect can it be said that agriculture is a "declining industry."

During each year of the 1960's, our agricultural plant will use more capital, more science and technology, more managerial capacity, more purchased production inputs, more specialized marketing facilities, and more research than the year before. It is obvious, therefore, that those writers and analysts who refer to agriculture as a "declining industry" look only at a single phase of this growing and important American industry.

We don't think of air transportation as a declining industry just because a pilot in a jet airliner can now take 100 passengers from coast to coast in half a day as compared with 20 passengers in a day and a half two decades ago. This, like agriculture, is a strong and growing industry.

The next decade will witness a tremendous upsurge in efficiency of producing meat and milk. Changes here will be comparable with those in the broiler industry in the 1950's.

Before 1970, science will have moved into the pig pen, the beef lot, and the milk parlor in a big way. We'll be making a pound of lean pork with less than three pounds of feed in contrast with five or six today, a pound of good quality beef (without the four ounces of excess fat to be discarded) with one fourth less feed than today, and a gallon of milk with much less feed. This will result in lower costs, and consequently relatively greater bargains for Mrs. Consumer at the meat counter or dairy bar.

This means a pronounced shift toward animal agriculture by 1970. Per capita consumption of livestock products will increase markedly, while per capita consumption of crops, especially cereal grains and starchy foods, will decline. This shift in our eating habits will move substantially toward solution of our chronic feed grain surplus. And, equally important, all America will live happier and healthier lives because of the improved diets made possible by the scientific breakthrough in livestock production.

By 1970, the unduly long hours of farm toil and drudgery will be only a conversation topic among the old-timers. We'll use a fourth fewer man hours of labor for farm work to produce a fourth more output. Family farms will be larger with much more capital—*but still family farms*. It will not be uncommon for a good family farmer to operate a unit of 400 to 600 acres, with a quarter million dollars invested in his business. In such cases, one hundred thousand dollars or more will represent working capital, such as machinery, livestock, feed inventory, and current supplies. An increasing share of this capital will come from off-the-farm sources, either from specialized credit agencies or from farm suppliers through some contractual arrangement. This does not mean that the individual farmer will lose his independence through integration. Instead, it means that he will enlarge his earning potential by increasing his volume through the use of outside capital and planned coordination of his farm production with the processing and selling phases of the total food and fiber industry.

Many production practices of 1970 will bear little relation to those of 1960. The relentless march of science will revolutionize agriculture. Crop cultivation will have

been rendered obsolete by pre-emergence weed control. Highly effective herbicides and pesticides will do the rest. One operation seedbed preparation and planting will be the rule. Larger power units will permit one farm worker to cover far more acres than today. The type of power itself will change as we move into the Nuclear Age. Before 1970 you may be able to purchase a nuclear farm tractor with enough fuel locked in it to last until the bearings wear out.

Chore time labor in 1970 will be reduced by a third as building rearrangement and automation bring us closer to "push button" meat production. The livestock feeder won't necessarily be tied to his "twice a day" chore time stint at the barn. He can take the week end off, if he chooses, for a pleasure trip with his family, just as his city cousin does now.

Farmers will produce to a predetermined market with respect to quality, time of marketing, and type of product. No longer will they produce anything and then seek a market at whatever price it will bring. They will use their knowledge of genetics, physiology, and environmental factors to produce "to specification" for a particular kind of market demand, just as industry now does. This will enhance selling price and income.

One fifth fewer farmers in 1970 than now by no means portends decay of the rural community. It will be stronger than now, although substantially different. Large numbers of urban workers, many of them former farm families, will live in the country. There are very few rural families, almost none east of the Mississippi River, who do not live within commuting distance of urban employment. As these urban-oriented families intermingle with farm families in church, school, 4-H Clubs, and social occasions, a new rurban culture will emerge. This will combine the best of our present rural and urban cultures.

In this environment, the commercial family farmer, using large amounts of capital, science and technology, will increasingly assume the characteristics of a business establishment. The farm manager will assemble "packages of technology" which have been produced by others on a custom basis. The share of total farm receipts spent for production items will increase still further; the gross margin per dollar of receipts will become narrower and profits will depend increasingly on growing volume.

The rural "businessman" running the farm of 1970 will think and act much like any other "businessman", whether he happens to live in city or country. A new community culture will emerge in which the farmer will be less conscious of his vocational identity, just as the lawyer, the doctor, or the machinist now loses much of his vocational identity in his own community life. The differences between rural living and urban living will have narrowed markedly. The farmer will be a businessman in much the same sense as is his city cousin. He will demand and will receive comparable levels of income and of satisfactions from life.

Dairying

Dairymen will aim for 350,000 pounds per man

Samuel T. Slack, Department of Animal Husbandry

DAIRYING is in a period of rapid change and new developments. Greater strides were made during the past ten years than in any like period in the history of dairying. Even greater advances are indicated in feeding, breeding, and management of dairy cattle for the 60's.

The number of farms in New York State declined 53 percent since the peak of 1900 of which one third of the decline occurred in the past 10 years. At the same time, land per farm increased. This trend toward fewer and larger farms, accompanied by the need for higher capitalization per farm, is expected to continue during the next decade.

We can look forward to a steady increase in milk production per cow, much of which will be due to better feeding practices. Dairymen will continue to improve fertility and the productivity of their soils so that they can produce a more adequate feed supply. They will exercise more complete control of the harvesting, storing, and processing of forage crops than in the past to insure quality of stored forages. Adverse weather during the harvest season is still a major deterrent to production of top quality forage. Harvesting a greater part of the first-cut forage as grass silage or the use of natural or heated air drying systems are increasing and appear to be preferred methods of insuring high quality forages. The average cow in New York State produces 7700 pounds of milk annually, however, it is expected to be near 9000 pounds per cow by 1970.

Milk production per worker will increase as a result of better feeding, housing, and labor-saving equipment allowing for increased number of animals per worker. Top dairymen will aim for 350 thousand pounds of milk sold on a per worker basis. Indications are for a more general application of labor-saving equipment to facilitate the handling of milk, roughages, grains, and manure. Many current stanchion barn situations will add milking parlor facilities with appropriate holding area arrangements. Indications are that bulk tanks will have completely replaced the can during this period and bulk milk hauling to the processing centers will have been completed.

Records of the farm business are currently a necessity and will be even more important in the future. The use of milk production records as a means of culling, feeding and breeding as a part of farm records will increase. In New York State about 40 percent of the dairy cows are being artificially inseminated. It appears that 70 percent of the dairy cow population will be artificially inseminated in 1970, or about one million cows. Artificial insemination has demonstrated that it can give the service that farmers demand and can achieve results above those obtained in natural service. While the general trend in butter fat production has been increasing, artificial insemination has speeded up this increase. Techniques will be further improved to more accurately evaluate the genetic worth of sires used in artificial insemination.

Marketing

Convenience foods will boom

Brian R. How, Department of Agr. Economics

NEW products, new methods, and new firms will bring many changes in farm product marketing in the decade ahead. The developments of the fifties will be completely overshadowed by those of the sixties. We are on the threshold of many exciting innovations, which will materially affect not only consumers and marketing agencies but farmers also.

Rising consumer incomes and continued population growth will expand effective demand to provide markets for the most unusual goods and services. At the same time, ingenuity and invention will combine to break the technological barriers to the solution of marketing problems.

To food shoppers the most apparent change in marketing will be the number of new products offered, and the way these products are packaged and displayed. The total number of products available in a typical supermarket may not increase as rapidly over the next ten years as it has in the past, for more existing lines will be discontinued as new products are added.

Many new products will be completely different, and not just minor changes to gain temporary shelf space. They will be the result of new processes and new methods of handling. Some examples recently introduced or in the testing stage include sterile concentrated whole milk, potato flakes, dehydrofrozen baby food, and boil-in-a-bag frozen vegetables.

These new products will have two common characteristics. First, and foremost, they will be acceptable to the consumer in appearance, in taste, and in ease and speed of preparation. Second, they will be capable of efficient handling through marketing channels from point of production to final sale.

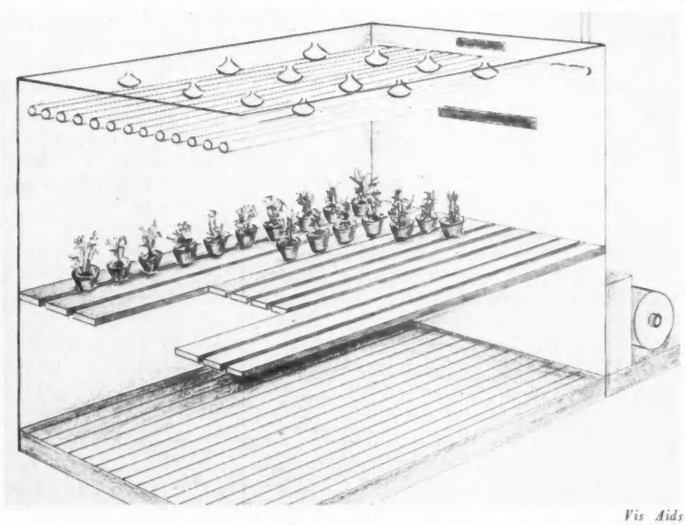
Farm product marketing, in spite of its importance in the economy, has lagged in adopting methods. The bulk, perishability, and variability of most farm products has restricted mechanization in spite of rising labor costs. The growth of processing by itself will partly overcome this obstacle, but machines will be developed to handle unprocessed products also.

Electronic egg grading and packing equipment that reduces direct labor requirement to a minimum is already in commercial use. Apples, onions, or potatoes may be next in line as improvements are made in the process and equipment costs reduced.

Milk will be produced and bottled in automated plants, where machines not only perform the necessary operations, but also check their own performance and make adjustments where necessary. In grocery warehouses products will be selected and assembled by an operator with an I.B.M. machine, as already is the case in at least one frozen food warehouse. Records necessary for buying and selling, for inventory control, and for management decision-making, will be stored and processed on electronic equipment such as that in use in a few food distribution centers already. Among the many new devices to be installed in retail stores will be equipment to assemble, bag, and carry out customers' orders.

Standard containers eight feet wide and eight feet high and varying in length, that can be easily transferred from truck bed to railroad flat car to ship's hold, will be used to transport commodities from one location to another.

The new products, and the improvements in methods of handling existing products, will encourage new firms to develop in the marketing field. These firms will be new in a particular sense only. They will be larger in size than many at present because of the specialized equipment and knowledge needed to operate effectively, and the advantages of size in distribution. The functions they perform will be combined in different ways. Some firms will be more highly specialized than present businesses, while others will assume additional responsibilities. The net result will be that ownership of farm products will be transferred fewer times between farmers and consumers than is the case today.



Vis Aids

A unit of the proposed bioclimatic laboratory at Cornell. This laboratory would enable scientists to work with exact quantities of light, temperature, and humidity in performing biological experiments.

Assembly and primary processing firms like milk receiving plants, potato packing sheds, egg grading stations, and livestock slaughtering operations will take in larger territories and deal directly with processors or retail food chains. The food chain, corporate or voluntary group of independents, will assume the functions of distribution locally.

All these changes will not occur without important effects on farm production. Changes in marketing will be responsible for changes in the location of production of many products, and the organization and operation of the farms that produce particular products. Efficiencies in transportation and the ease of transporting processed products will eliminate much of the advantage of producing products close to consuming centers. Instead, output will move to areas best adapted to efficient production.

Consumer preferences and marketing methods will place increased emphasis on the need for more uniform quality of product, better scheduling of production, and sufficient volume from each individual farm operation. More farmers will select crop varieties according to market requirements, more cows will be bred to freshen when plants can best handle the milk, more farms will be organized to enable delivery in sufficient quantity to minimize costs of handling, supervision, and accounting.

Genetics

Knowledge of gene chemistry will increase

Adrian M. Srb, Department of Plant Breeding

GENETICS is the science that deals particularly with the biologically heritable systems having control over the nature of living things. Genetics, at this point in time, is a highly exciting science. Over the past ten years or so, the problems of genetics have attracted chemists, physicists, and mathematicians, as well as workers in almost every area of biology.

The combined efforts of investigators having so great a variety of knowledge and technical skills, and of points of view, have led to rather amazing advances. As a result, sooner than most biologists expected, we have preliminary but highly suggestive and well-founded clues as to the nature of life and of living systems as they may be understood and defined by the scientist.

Some of the further advances to be made during the next decade can be more or less anticipated. Certainly much more will be learned about the chemical nature of hereditary materials. "Genes" are structured entities carrying hereditary information from one generation to the next, and are the ultimate source of definition of the chemical capacities that determine the properties of a living individual. At present, genes are known to be composed at least in part of the substance deoxyribonucleic acid (DNA).

For example, certain organisms that are able to synthesize a particular vitamin may have close relatives, sometimes in the same family, that cannot synthesize the vitamin, and do so because they have inherited particular pieces of DNA. Their deficient relatives have inherited corresponding pieces of DNA that somehow are chemically-physically different, and are incompetent with reference to vitamins synthesis.

Over the next few years, biochemists are likely to describe in accurate chemical terms at least some of the pieces of DNA that determine the chemical potential of living things. This will mean that a fundamental mystery of life will have a solution able to be written as a chemical formula.

In a few species of bacteria, hereditary materials may be provided by means other than the normal reproductive processes. Chemically pure DNA isolated from bacteria with particular characteristics can be supplied to similar bacteria with alternative characteristics. Some of the recipient bacteria incorporate the externally derived DNA into their genetic machinery, and transmit to their progeny characteristics peculiar to the bacteria from which the DNA was derived. Isolated DNA of this kind essentially represents "genes in a test tube." A good deal more of heredity by injection, at least for experimental purposes, can be expected, although the techniques may need to be varied from organism to organism.

Increased knowledge of the chemistry of genetic materials increases the probability that they will in some instances be predictably alterable. High energy irradiants and certain chemicals are already known to have the capacity for altering genes, although not with pronouncedly predictable specificity.

One now finds it possible to suppose that particular chemical treatments will be able to be altered at will, in ways favorable to man's intent.

Geneticists will undoubtedly pursue their investigations in new ways. Some imaginative investigators believe that the sequential arrangement of genes in humans can be studied more effectively by appropriate genetic study of human cells in tissue culture than by the orthodox method of tracing hereditary characteristics through family pedigrees. Similarly, certain kinds of genetic studies of higher plants in tissue culture seem feasible. Before too long, plant breeders may be growing some of their experimental material in flasks as well as in the field.

Substantial advance can be expected in medical genetics. Even though defective genes may not be curable, increased understanding of the physiological consequences of possession of defective genes will permit more effective treatment of genetic lesions.

Finally, in this space age, the possibility cannot be ignored that geneticists will be involved in comparative interplanetary genetic studies. Among organisms on earth, from viruses to man, differences in genetic systems seem to be no more than minor variations on a theme. If life exists on other planets, geneticists will be most eager to see whether quite different genetic mechanisms have evolved. For example, will DNA again be at the center of things? Perhaps for the moment the safest and most elegant answer can be taken from Shakespeare. "There are more things in heaven and earth, Horatio, than are dreamt of in your philosophy."

Conservation

Man's use of environment has to be planned

Carl A. Carlozzi, Department of Conservation

IN any community there are two basic areas in which reconciliations must occur if the community is to persist without discord and uncontrolled change. The first is the internal strife between members of the community which compete naturally to meet certain requirements. The second is the frictions that arise between the community and its resource base or environment.

When we observe the efforts of man it is apparent that the bulk of energy has been largely directed toward resolving the first kind of conflict. That is to say, man is primarily concerned with man. This concern has been formalized in the structure of our morality, law, economics, politics, and arts. There has been over the past hundred years however, a growing effort towards interpreting man's position relative to his total environment. This effort has been made primarily in the area of science. While a preponderance of knowledge gained in this field has been used for and concerned with man relative to man, greater efforts are being made to apply this kind of knowledge to the community of man relative to his resource base or natural environment. Conservation is, of course, the organized effort in this area of activity. That is, conservation has been concerned primarily with resolving the problems which occur as the community of man interacts with its environment.

Today we are experiencing the beginning efforts in American society whereby the two basic areas of conflict can be treated simultaneously. The concept involved has been called both "Area Development" and "Regional Planning." While the words are not new, the scope of the factors involved in this kind of planning is considerably greater than in past years.

Geographically, regional planning takes in relatively large areas and often looks to natural boundaries (e.g. watersheds or river basins) to delimit its working area.

Investigations involved in such an effort include not only the physical aspects of a given region or watershed, its water, soils, plant and animal communities, topography, minerals, etc., but also attempt to assess man's position and development within the area and the ability of the area to meet the demands inherent in development.

Foremost in this kind of planning is ordering the growth and changes subsequent to growth in our society so that serious upset of the human society and the resources of the area will not occur.

Problems such as flood plain encroachment, land use planning, providing adequate water supply, meeting recreational demands, continue to be a part of our daily living. Our past piecemeal approach to solving these has not proven successful. And, our growing population and increased societal complexity are adding to these problems with each passing year. The importance of understanding our position relative to our resource base, upon which we are dependent, cannot be minimized. Orderly development through sensible planning seems inevitable. What we need is the courage to accept the kind of broad planning which can offer us alternatives of development, to ensure the continued improvement of human society, and at the same time maintain the integrity of our environment.

Plant Pathology

The evil of all roots: plant disease

George C. Kent, Department of Plant Pathology

THE science of Plant Pathology has completed the change from a purely descriptive science to one of analysis of basic factors, or relationships: pathogen to plant, pathogen to environment, pathogen to fungicide, and the plant to any factor or factors causing disease. These fundamental approaches to the explanation of disease and the causes of disease are being rapidly broken into a number of different specialized fields of study, each of which is making rapid changes.

Changes in fungicides and the control of diseases by chemicals will be less frequent during the next 10 years than in the last. Recently there has been increased awareness of possible human toxicity from cumulative chemicals. As a result, requirements for either proving chemicals non-toxic to humans or using them in disease control so as not to leave a residue on the marketed product, will slow production of new chemicals and greatly increase costs. However, a drop in the speed and ease of producing new protective chemicals will boost the search for systemic fungicides. These systemics are thought to be non-toxic to humans and hence less risky when found. The end of this decade will probably find systemic fungicides of the more general types coming into commercial use. Research into the more specialized truly systemic fungicides should be well advanced.

Knowledge of plant viruses

should increase rapidly during the decade. The present studies on the structure and formation of the active particles — nucleoproteins — are interesting and promising. We should by 1970 know whether the active portion is the nucleic acid or the complete nucleoprotein; whether insects pick up an entire molecule or only a portion as they pass the agent from one plant to another; and when the infective particle gets into the host plant whether it reproduces itself from amino acid particles or from inorganic nitrogen and carbohydrate fragments.

There is real evidence that we will know something of the nature of the cause of disease. Studies of the action of fungi and nematodes in interfering with the physiology of the healthy plant are begining to give suggestions of how the pathogen does its work. Studies on rust fungi and other organisms attacking leaves are pointed at determining the portion of the respiratory cycle affected by the pathogen's toxins of antimetabolites.

The greater advances, however, will be made in our knowledge of root decay. At present little or nothing is known of the nature and cause of the decay of roots. There is evidence that more crop losses are due to root troubles than to any other group of troubles, but this area of plant diseases has been entirely neglected. This may be because our cultural techniques as used on the aerial parts of plants do not work on roots. It may be because root decay is not the result of the action of a varying complex of organisms and edaphic conditions. Plant pathologists are beginning to put some of the isolated factors together in a way that makes it plain not only that there is much to learn by studying root diseases, but that crop production can be greatly increased by learning now to grow plants with healthy, fully active roots.

Stran-Steel

The latest in poultry housing has slatted floors, pit cleaners, automatic feeders, waterers, and thermostatically controlled ventilation system. The galvanized steel sheets form a vapor barrier. The walls and ceiling are insulated.

Weather

Forecasting will be longer range, more accurate

Bernard E. Dethier, Department of Meteorology

IMPROVED accuracy of weather forecasting has depended upon technological advances in other fields. During, and previous to the mid 1800's forecasting was restricted to local guesses and weather folklore. A few of these weather proverbs are:

When the sun is in its house (halo) it will rain soon.

Red in the morning, sailors take warning. Red at night, sailor's delight.

These proverbs were the result of searching for signs of the future weather. Some of the weather sayings reflect what we now know to be basic meteorological principles.

The first real advance in forecasting had to wait until a rapid means of communication was developed, so that man could extend his vision beyond the local horizon. Morse supplied the means with his invention of the telegraph about 1840. By 1870, systematic collection of weather data, interpretation and crude forecasting service had been established in many countries.

Storms, then as now, were the principle concern of the forecasters. A large majority of storms originate over the ocean areas. Marconi's invention of the radio (1900) enabled ships at sea to transmit weather observations for the first time. Now, the forecaster had some inkling of the weather occurring over the 70 per cent of the world's surface previously denied him.

During the 1930's the invention of the radiosonde by Molchanoff made possible the systematic sampling of the upper atmosphere. Storms were now examined in the vertical, as well as in the horizontal.

A decade later, von Neuman adapted the electronic computer to the processing of weather data, which by that time, had become so voluminous that it was impossible for man to handle it without help. There are now over 10,000 weather stations on land, over 3000 ships reporting weather and more than 1000 stations reporting upper air conditions. These various stations send in scores of reports daily. Although this may sound like adequate coverage of our world there are many areas where coverage is so sparce as to be almost useless.

The development of radar helped to fill the voids between stations and the use of rockets, to carry weather instruments to greater heights, allowed a more comprehen-

New De Laval Combine Milker brings you "Turbulent Action" Automatic Washing

Water bottle test shows you why "Turbulent Action" gets pipelines cleaner, more sanitary – and saves you money, besides!

These action photos dramatize the difference in cleaning power between ordinary in-place *pressure* systems and De Laval's "Turbulent Action" *vacuum* method.

Bottle at left is *half-filled* with water. See the turbulence when it's shaken? This is how De Laval *vacuum* cleaning works. It pulls water through lines at up to 35 mph with great turbulence to scour away fat and milk deposits.

Bottle at right is *filled* with water. When shaken, no turbulence occurs. That's how *pressure* systems work. They fill lines with water then push it through at only 4 mph without turbulence. Only "Turbulent Action" can give you truly sanitary lines, lowest bacteria counts, highest quality milk.

What's more, De Laval's Automatic Washer uses 60% *less* water, *less* electricity, 60% *less* detergent. With *pressure* you'd use 78,840 gallons of water a year for a 50-cow herd... only 32,850 gallons with *vacuum*. And only 228 lbs. detergent as against 547 lbs. with pressure.

FAR BETTER MILKING, TOO—Of all pipeline milkers only De Laval's Combine Milker gives you fast, clean and gentle milking. That's because only De Laval has *absolutely uniform pulsation* and *narrow-bore liners*. Result – better udder health, less mastitis, more milk. See your De Laval Dealer. Get a Combine Milker with Automatic Washer. You'll save time and labor, make more money. *Barn or parlor layouts cost as little as 3¢ a cow per milking.*

SET IT... FORGET IT!—just add detergent, flick the "wash" switch and walk away. This control panel does the rest... pre-rinses, washes, clean rinses, then shuts itself off—*all unattended.* Sanitizes automatically, too. And unlike all other CIP systems, it *never* re-circulates the same rinse water. The De Laval Separator Co., Poughkeepsie, N. Y., *or* 5724 N. Pulaski, Chicago 46, Ill. De Laval Pacific Co., 201 E. Millbrae Ave., Millbrae, Cal.

10% down... up to 4 years to pay

DE LAVAL

COMBINE MILKER®

sive vertical picture of the atmosphere.

The final pieces of the world-wide weather picture will fall into place in the near future with the help of television-equipped satellites orbiting hundreds of miles above the earth. Then, for the first time, the meteorologist will be able to see the complete weather picture and he will not have to rely upon a picture a few hours old, based on interpolation of scattered observations.

High speed computers and satellite information will allow the meteorologists of the 1980's to approach 100 per cent accuracy in their forecasts. The daily forecasts of the future will also be more detailed both in area covered and in the statement of the times of beginning and ending of various weather phenomena. The long range weather outlook, at present only 30 days long, will improve. By 1980 the outlook will be day to day forecasts, similar to the present daily forecasts, but for a period three months in advance.

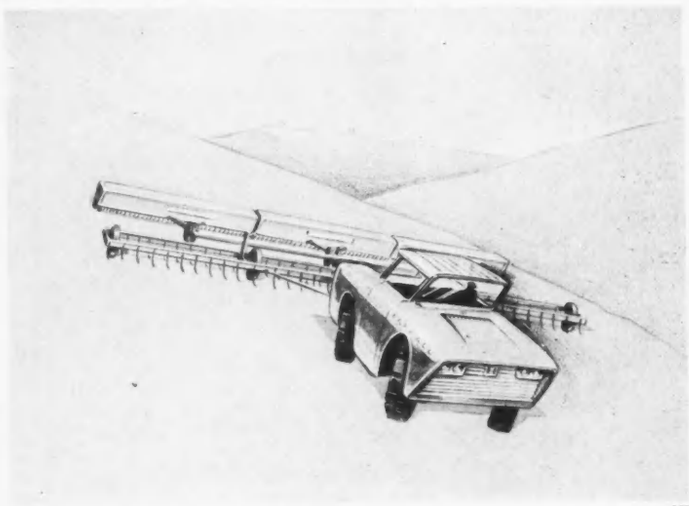
Engineering

Automation will sweep the farm

Ronald B. Furry, Department of Agr. Engineering

WITH 80 per cent or more of the labor on dairy farms now occurring in or around the buildings, the next logical approach to increasing labor efficiency, or reducing total labor requirements, should be to mechanize, simplify, or even eliminate the major repetitive jobs performed daily. A loose housing system of managing dairy cattle offers some improvement over a conventional stall barn system, but present techniques of handling feed, milk, cattle, and waste products, still leave something to be desired.

One job that needs urgent attention is that of handling the millions of tons of forage for dairy animals. Self-feeding is only a partial solution to this problem. New machines to help simplify the handling of forage will be developed. Whether the machine's end product is called a wafer, a Hayfer, or a pellet is immaterial. The important thing is that the forage bulk will be reduced and that the uniformity of the product will make it easier to handle with mechanical equipment. This is important not only in moving forage in and out of storage, but it is also important in metering the correct amount to a cow according to production. The job is only half completed when modern field machines deliver the forage to the warehouse and then let a two legged servo-mechanism with a front-end shovel unloader meter the stuff haphazardly to the cow.



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A turbine engine or a free-piston engine may be pulling the U.S. farmer's tractor through fields within the next 20 years according to International Harvester.

Devices that are both experimentally and operationally sound are in existence that can relieve men of this silage feeding chore. The feeding schedule can be programmed into the mechanism to meter out silage according to the cow's requirement, actuate an unloading device that is synchronized with a conveying system, and shut the whole works down when the last cow is fed. It might even qualify for the "fully automated" title if the whole system can be integrated well enough to also turn itself on when required and monitor its own operations. The farming aspect of agriculture has not even scratched the surface of electronic control use to relieve the man for more important managerial tasks.

Probably the most lucrative part of the dairy operation is milking. This activitity has gone substantially unchanged for many years. Engineering techniques and equipment related to the handling of the milk are relatively well developed. It is the handling of the cows that causes the trouble. Conventional types of milking parlors have improved the situation somewhat. The more recent development of the herringbone milking parlor allows one man to milk 40 to 45 cows per hour and do an excellent job. But even this is not the panacea of the milker. Why? Because there should be no milker. An *observer* should be all that is required and the system should handle more cows in less time.

A system that comes close to modern, large herd requirements is already in use on the West Coast. It enables two men to wash, feed, milk, and otherwise care for cows at the rate of 100 per hour. The system is expected to pay for itself from savings in labor charges alone in six years time. The equipment won't wear out in that time. The important thing to note is that it

could be modified to eliminate one of the two men from the operation that are now used. Then one man could milk 100 cows in one hour. After that, the only step left is to go full circle and make the system fully automatic—from the application of the milking unit to the keeping of the cow's records on the farm.

Dairy housing is certain to undergo change as research yields more and more information about how the dairy animal's environment affects her production, health, longevity, and general welfare. It may very well be that a slow but continuing increase in the average temperature of this hemisphere will see not only the human population in a more closely controlled environment, but some of our more important animal species as well. Dairy regions of the Southern United States could capitalize quickly on findings from the psychroenergetic laboratories and could economically increase production of dairy animals by placing them in a controlled air conditioned environment. Perhaps rapid population expansion will make this a closer reality than we can now perceive.

Dairy Manufacturing

Dairy manufacturing is due for a revolution

J. C. White, Department of Dairy Science

WHO can tell what will be happening in dairy manufacturing in 1970?

Many things are possible. We can conjecture that the whole field of milk distribution will be radically changed; that in our metropolitan markets there will be essentially no door-to-door delivery and perhaps no great sales of fluid milk because the experimenters in laboratories have had success in producing a milk powder or a concentrated milk of extreme flavor stability and free of the defects which have accompanied these products to date.

We can prognosticate that there will be very few dairy farms of family size. Only the largest of farms may be in operation and only the largest of plants may be handling the milk.

We can conceive that milk will be carried extremely long distances by tank truck or by air transport and we could even conceive of milk becoming a public utility because of its public health significance. All of the small plants may disappear and milk may be processed completely by automatic equipment from the farm to the final product and distributed to the public by semi-automatic or automatic channels.

We may even have a pipeline spanning New York State to carry milk from Buffalo, Rochester, Albany, Syracuse and Watertown into some central location such as Cortland or Elmira where it could be processed in a huge plant geared to use atomic power for changing the perishable nature of milk into whatever the product would be.

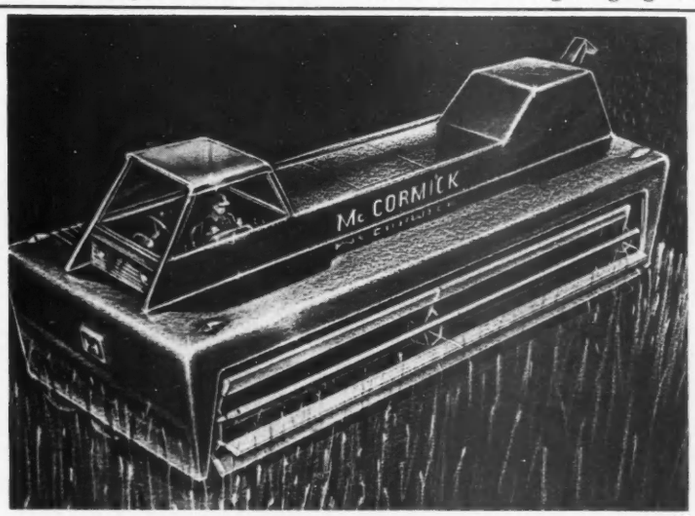
None of this is likely to happen, but the things that do happen are likely to be as surprising and as strange. All we are sure of is that things will change and that they will change more rapidly as time goes on.

The last ten years have seen more changes in the dairy industry than have occurred in all of the time since the first factories were built in New York State about 100 years before.

In 1970 we will have a solid dairy industry in the Northeast. Our climate is geared to the production of milk. We have rolling country suitable for dairy animals, and about the best crop we can raise is roughage . . . admirably suited to be run through a cow. The cow itself is admirably suited to the production of food, provided we can afford to run our food through an animal before it is offered to humans.

Our cows produce high quality milk from acres which are sometimes uncroppable and they use roughages which are not usable directly by humans. From unusable material they produce about 25 percent of our food and the highest quality product, in terms of vitamins, minerals, and protein, in our diets.

Of course, we could produce food more cheaply from crude materials in a yeast tank, but who wants to eat yeast when he can get fine dairy products? We believe that the American economy will support an animal agriculture and that the cow is the most versatile and most efficient in turning roughage into



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Harvest 100-200 acres daily and do it within the air-conditioned shock-absorbent interior of this streamlined combine. All the operator has to do is turn corners. Routine guiding and adjustment is done automatically.

The Most

Important 5 Minutes

in a Dairy Farmer's Business Future...

. . . could be the five minutes it will take to read this ad. The reason why we know that this message is important to dairy farmers is because Eastern Milk Producers are all dairy farmers . . . 100% an organization composed of dairy farmers.

Stated basically, Eastern's position is that dairy farmers need the influence of a cooperative and that this is best provided by a bargaining cooperative such as Eastern. Because it is primarily interested in achieving higher prices for dairy farmers, Eastern has no conflicting interests and speaks loudest for dairy farmers.

- **REPRESENTATION.** All of Eastern's officials and delegates are elected by the dairy farmers who make up Eastern's membership.
- **LEGAL AND ECONOMIC COUNSEL.** Eastern provides experienced legal and economic counsel to dairy farmers in legislative and marketing hearings . . . with individual service available to each member at other times, as well.
- **COMMUNICATION.** In addition to a monthly publication, Eastern publishes a quarterly news letter and special bulletins when special occasions demand. Eastern's members are the best informed dairymen in the country.
- **MARKETS.** One of Eastern's most important functions is to assure each member of a market for his milk production . . . at the highest possible blend price.
- **INCOME PROTECTION.** Eastern's members are also provided income protection in the event of quarantine or temporary loss of his market.

Well, there are other benefits, of course, and membership in Eastern Milk Producers provides more of the cooperative advantages that are exclusive to dairy farmers.

The five minutes spent reading this ad are important. Important, too, are the few moments it takes to contact your area Eastern Field Representative, or write direct to Eastern, Kinne Road, East Syracuse, New York.

Eastern

Milk Producers
Cooperative Association Inc.

The Progressive,
Effective Co-op

human food.

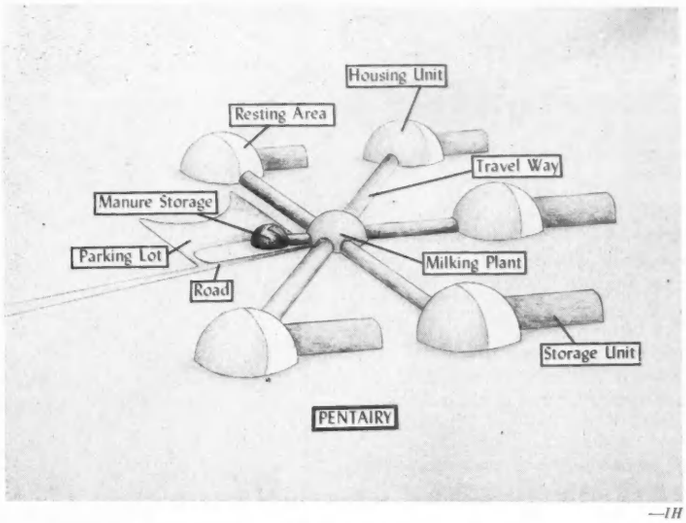
We will still be using fluid milk. It will still be harder in 1970 to open a can and dilute it with water, or to beat up a powder, or dissolve a pill than it will be to take the cap off a milk bottle or open a paper carton.

We firmly believe that the flavor of fine, fresh milk will be better than that of the manufactured product and the price of the fluid milk will compare favorably with the manufactured substitute.

We will still have a number of competing companies and we will still be handling some milk in cans, but almost all will be in bulk.

Our dairies will be bigger; there will be fewer of them. Our milk plants will be bigger and there will be fewer of them.

However, the pure, clean lacteal secretion of the healthy cow will still be one of the favorite foods of the consumers in New York State.



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Five hundred cows can be kept in the dairy barn of the future. The "Pentairy" designed by Cornell Agricultural Engineer Ronald B. Furry holds 100 cows in each of its five resting areas. Each resting area is connected to the giant central milking parlor. Milking would go on 20 hours a day with men working in shifts. The whole system is air-condtioned.

Animal Nutrition

Dairy cattle will be fed more grain

J. K. Loosli, Department of Animal Nutrition

TODAY the average dairyman in New York State is underfeeding his cows. Because of the artificial breeding program the producing ability of his cows has been markedly improved, but his feeding and management has not always kept pace. As a result, many dairymen never find out which cows are the really good ones.

Most cows now carry adequate conditions at calving time, but the level of grain feeding is increased too slowly as they start lactating and they are not allowed enough concentrates to reach their full potential. The successful New York dairymen a decade from now will follow a feeding procedure about like this.

The week before calving the dry cow will be fed 8 to 14 pounds of concentrate mixture depending on her condition. There will be no decrease in concentrate feeding unless the cow becomes ill and appetite fails. Each day following calving the concentrate allowance will be increased approximately one pound until the maximum of 18 to 28 pounds is reached, depending upon the milk yield.

The exact rate of increase and maximum concentrate allowance will, of course, depend upon the cow's appetite as well as level of milk yield. Highest producers in top herds today are sometimes fed as much as 36 pounds of concentrates daily for months. This indicates the safe potential for the best cows in any herd.

Simple udder edema need not be considered a reason to restrict concentrate feeding. Severe cases can be controlled with new products veterinarians will have. Research has shown that level of feed intake has very little to do with the extent of udder edema at calving, so that cows which consistently show too severe udder edema should be discarded.

The quality of hay and silage is at least as important as the level of concentrate feeding. All good dairy farms will produce and feed early-cut, carefully preserved hay and silage like that now used on the best few.

Replacement heifers will be grown on limited milk, or milk replacers and concentrates, but with maximum use of top quality forage and pasture. They will be bred to calve at 20 to 25 months. Any excessive fatness will be avoided, because research has shown that fatness in heifers tends to reduce lifetime milk yields and reproductive performance.

Biggest changes in feeding dairy cattle will be the result of improved machinery for harvesting, curing, storing and automatic feeding. All phases of feeding and management will be affected by automation so that one man can handle more cows and produce more milk with greater efficiency.

Although there are fewer beef cattle, sheep and swine produced in New York State than dairy cattle these animals have real potential under some conditions. There is a lot of unused land in New York that could produce beef and sheep successfully. Recent nutritional developments may make it feasible to expand some of these animals.

Recent observations showing that grinding and pelleting poor quality hay makes it about equal to the best hay for sheep and beef cattle offers a new method of using some of our poor hays. Pelleted alfalfa is almost equal to concentrates for fattening steers or lambs on a partial replacement basis. Our nearness to big markets offers promise for future development of early lamb production.

Special cooperative marketing arrangements have helped to stimulate swine production in some areas. In the future efficient swine nutrition will not involve pasture. Complete rations adequately fortified are available for rapid early starting of pigs and for finishing them to 190 pounds in four to five months. These feeds, along with proper breeding, help to give leaner pork now in demand and smaller, leaner cuts. A combination of confinement management and careful nutritional balance of rations form the basis of successful swine production in the years ahead.

An engineless tractor. A reaction of gases in the 1008 fuel cells provide electricity that drives the tractor. Because the chemical energy is converted directly to electrical energy there is no heat loss, giving a 90% fuel efficiency. This compares with 40% for the best diesel fuel.

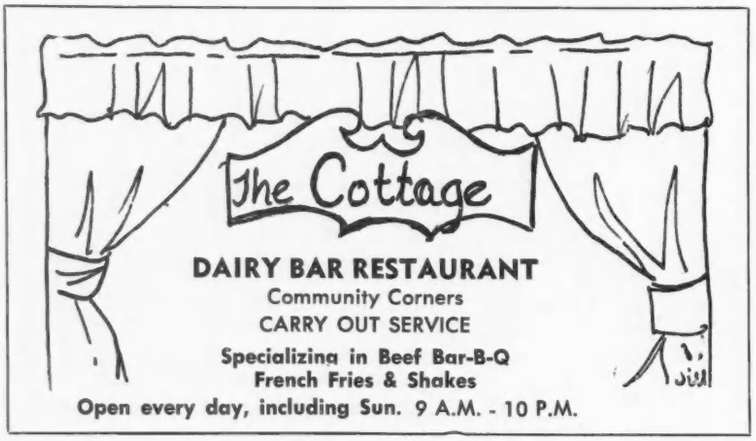
Water

Modern agriculture will demand more water

Nyle C. Brady, Department of Agronomy

In the next decade our activities relating to water resources will probably influence the future of agriculture in this country more than anything else we do. Even in a humid state such as New York the supply of water controls crop production probably more than any other single factor. Every year we have sections of the State which suffer from droughts, overly-wet conditions or destructive erosion, all of which are related to our water resources and to our lack of control of them.

In the past only the western half of our country has shown real concern with water. To western farmers water and survival have been essentially synonymous. In the drier areas irrigation has been as important in the development of the West as was man himself. Consequently, politics and plans for water resource use are much


The Cottage
DAIRY BAR RESTAURANT
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Specializing in Beef Bar-B-Q
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better developed in our western states than in the East. Also, most of our applied agricultural research dealing with water has been carried out in the West.

The East has only recently begun to realize what dependable supplies of water can mean to a permanent agriculture. This is best evidenced by the rapid increase in irrigation throughout this area. Since 1949 the area of irrigated cropland has increased from one million acres in those states east of the Mississippi. In New York, irrigation has increased during the same period of time from about 19,000 acres to perhaps 75,000. Here, as elsewhere in the East, growers have recognized that in order to compete with other sections of the country they must control the water supply.

Significant progress will be made in the next ten years on 1) water use for agricultural purposes, 2) water resource policies and planning, and 3) research on water and its utilization. Irrigation will continue to expand in all areas of New York where sources of water are available. Most of this increase will be for irrigating vegetables and fruits where the return per acre is high. Some grain and hay crops will receive irrigation where "vertical" expansion of farming is practical. It is anticipated that the area under irrigation will more than double in the next ten years.

Important as is the actual practice of irrigation to agriculture, policies and plans for the use of water, and research on methods of most effectively utilizing it are perhaps of even greater significance. In a populous and industrial state such as New York the water needs of agriculture must be considered along with industry, municipalities and, of course, us and our families. We must attempt to develop and conserve our water resources for *multipurpose* use in our modern economy.

Long-term policies will be developed by appropriate public agencies which will permit, encourage, and even demand multipurpose use of water. There are ample supplies of water in New York State for all segments of the economy. The problem is one of control and allocation. Adequate planning will give agriculture its share of responsibility and opportunity for the use of New York's water resources.

Research on water problems will be greatly increased during the next decade. Applied research on water utilization for irrigation will be most apparent. We will likely pinpoint those soil, climatic and crop conditions under which irrigation is economical. We will perfect new methods of determining when irrigation water should be applied and the amount to be applied. We will initiate additional studies on the effects of soil cover and soil properties on yield of water from our watersheds for agricultural and other purposes.

Fundamental research on soil-water-plant relations will be greatly intensified in the next decade. Soil scientists will learn more about the movement of water into and through soils. They will study factors influencing water retention by soils and, with the plant scientist, mechanisms by which water is removed from soils by plants. These scientists will learn more about how this loss can be reduced. Their accomplishments in the next ten years may well chart the applied agricultural practices relating to water in New York State for decades to come.

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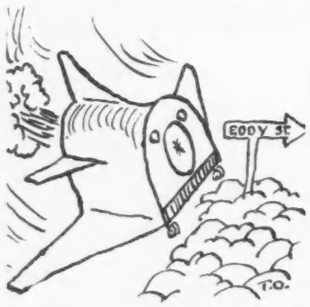

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Forage Crops

High Yields, fast growth will boost forages

Madison J. Wright, Department of Agronomy

We can be confident that in 1970 farmers will be growing and handling forage in ways considerably different from our present methods. But an even more radical change is likely in our attitude toward forage crops.

Much of the forage that makes up our present rural landscape is there by default; at the end of another ten years most of the forage on farms will be there because it has earned a place, and considerable acreages will have been eliminated because they were carefully examined and found wanting.

New varieties that are more precisely tailored to new situations, more desirable in chemical composition, easier to grow, and more resistant to disease, will replace the present varieties and especially the "common" or "commercial" seed.

The forage crops that are more efficient in capturing the energy of the sun will gain favor. However, it is unlikely that a whole set of new species will replace our present ones. It may be possible to adapt some highly productive southern species to parts of New York.

The language we use in describing forage is due for a major overhaul. We need both an enlargement of our forage crop vocabulary, and a refinement of certain terms now widely used. Two examples might be cited. "Roughage" is defined as a feed high in fiber and low in total digestible nutrients. On the whole it includes all leafy or stemmy plant material. Our modern farms produce a great diversity of products that can be classified as "roughages." Wheat straw is a "roughage." So is corn silage. So is ladino clover pasture. If we compare these on the basis of estimated net energy we find that the best "roughages" deliver six times as much net energy per pound of dry matter as the poorest. Certainly our growing knowledge of nutrition will encourage us to discard terms as crude as this one.

A more modern example is "quality" as applied to forage. This term probably means something different to everyone who uses it. While it has value as a part of the teaching process, it is too vague to survive long in our nutritionally sophisticated future.

Some kind of production goal will probably emerge fairly soon. This might take the form of a yield of harvested crop per acre. We would then find ourselves measuring our success by how closely we approached, say, 7 tons of alfalfa hay or 35 tons of corn silage per acre (these are examples, not suggested goals). On the other hand, the operator who processes his forage through his own animals may be more interested in a goal that represents the end result of both production and utilization. Dairymen might be aiming for (again, examples) 7000 lbs. of milk per acre from forage, beef raisers for 900 lbs. of beef.

Another type of goal is likely to be taken even more seriously: output of forage or animal product per unit of effort, or unit of nuisance. Here we deal directly with the farmer's abilities, inclinations, and the conflicting demands on his time.

New alfalfa varieties pose a problem. Research results make it clear that three, or even four, cuttings per year produce a greater aggregate yield than two. But is it worth the effort, or nuisance? An even more clear-cut example is daily chopping of fresh forage, variously known as "green feeding," "green chop," and "zero grazing." Many farmers have tried this, but not many stick with it for more than a couple of seasons because of the nuisance. They either return to a grazing system or advance to year-round feeding of hay and silage.

By 1970 the forage crops, having at last gained the stature of other crops, will be grown more carefully, handled more skillfully, and discussed more intelligently than is now the case.

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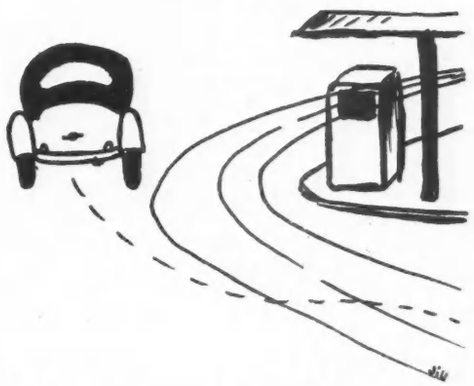

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Illustrations from: Finger Lakes Spice Trader/as prepared by Robert Eastman, Inc.

Spices

Here is how to buy and use spices—"The little things that make food interesting."

by Brenda L. Dervin '60

GRANDMA'S method of cooking—adding a pinch of this and a pinch of that from her spice shelf—may not be as out-dated as we think. The spice business is booming in the United States. In 1957, alone, Americans imported more than 113 million pounds of spices and produced about a third as much.

Probably the best evidence of this upswing in the use of spices are the spice counters in the supermarkets, according to Mrs. Helen Gifft, Assistant Professor of Food and Nutrition in the College of Home Economics.

Twenty years ago spice counters in the grocery stores were hard to find. Now, the elaborate displays in supermarkets are evidence that the use of spices to add flavor and interest and to get variety in cooking is increasing.

The flavor-giving qualities of spices have not always been considered their most important asset. According to reports from the American Spice Trade Association, spices were used as preservatives, perfumes, and even healing substances for many years before the birth of Christ. For this reason spices were as valuable as gold and the search for them led to the founding of new trade routes and the eventual discovery of the New World.

Spices, however, have always been valued at least in part for their ability to transform dull foods into palatable dishes. It is this quality that interests the homemaker today when she faces the large spice counter in her supermarket.

What spice gives what flavor? What spice is used with meat dishes, with soups? All these questions face the homemaker and need answers.

From the American Spice Trade Association comes these definitions which provide a basis for "spicemanship":

Spices—the buds, leaves, seeds, bark, and roots of aromatic plants usually grown in the tropics. The word "spice" often includes herbs.

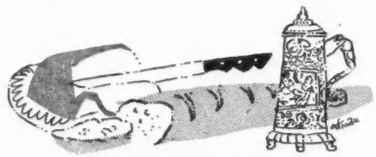
Herbs—the leaves of aromatic plants grown usually in the temperate zones, such as basil, mint, and oregano.

Vegetable seasoning—dehydrated vegetables in powder form, such as garlic powder.

Spice blends—dry mixtures of spice and herbs such as curry powder and poultry seasoning.

Seasoning salts—combinations of dehydrated vegetables with table salt, such as onion salt.

Condiments—liquid or semi-liquid mixtures of spice, herbs, or both with other ingredients, such as prepared mustard.



Mrs. Gifft adds that the word "spice" also has the popular meaning of hot or sharp, but "actually there are sweet, spicy-sweet, and hot spices." And, there are more sweet spices, like cinnamon, than there are hot spices.

Definitions alone, however, don't produce spicemanship. Buying is also important.

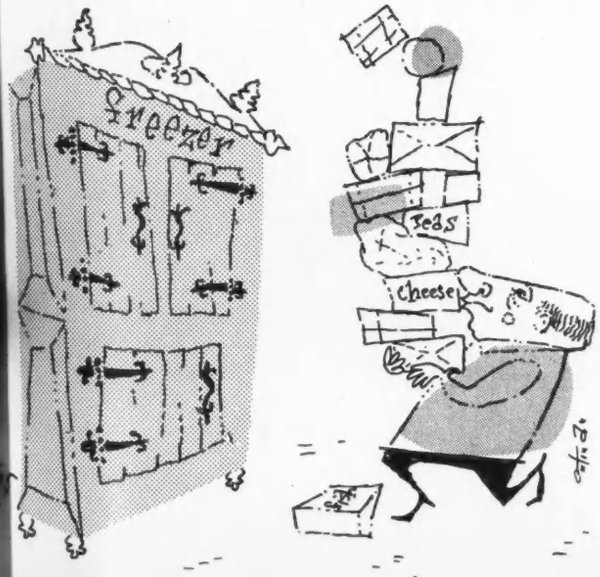
All spices lose some of their goodness in storage because their seasoning value depends on the oils present in the original plant. These oils are impaired with overexposure to air, dampness, heat, and light.

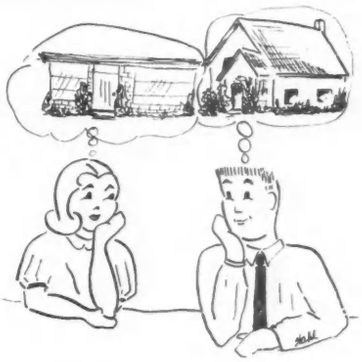
For this reason, Mrs. Gifft suggests buying spices in small quantities so they are used before they lose their flavor and odor.

The spice experts also suggest buying in stores with rapid turnover and selecting spices packed in tight containers. Spices in tin or glass containers keep their flavor longer than those in cardboard.

When the containers are transparent, the buyer should select spices and herbs that look fresh and have a bright color. In short, the buyer should remember that substances which give aroma and flavor will lose them in time. Whole spices keep their goodness longer than ground spices. And, leaf herbs keep better than powdered herbs. So, it's always better to buy whole spices or leaf herbs and grind or crush them at home.

Of course, Mrs. Gifft states, "the ultimate ideal of the true connoisseur is an herb garden so that fresh home-grown products are readily available." Cornell Extension Bulletin 841, "Culinary Herbs"





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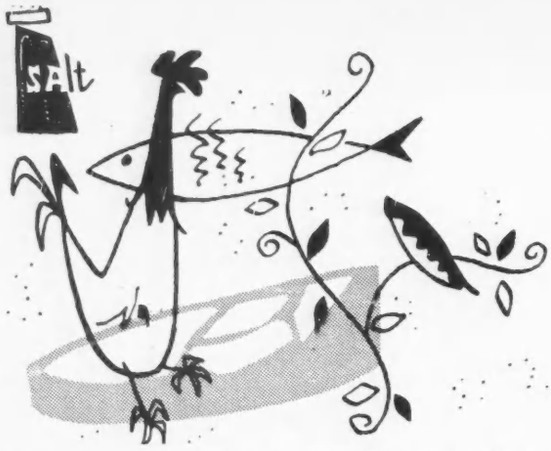

gives suggestions on how to grow herbs in a climate such as Ithaca's.

Storing is another problem facing the spice buyer. The experts suggest keeping containers tightly closed and away from warm places. It's best, also, to check quality from time to time—rub a little spice briskly between the palms of the hands, then smell the fragrance. If the fragrance characteristic of the spice is missing, it's time to buy again.

When buying, Mrs. Gifft adds, there are no real price indicators of quality. Usually the more expensive products have the finest quality. But, some the least expensive also have fine quality if fresh.

Quality and price are just two aspects of spicemanship. The buyer still has to decide what spice to buy. There are many charts and lists published by magazines and spice companies suggesting the right spice to be used in various dishes.

These charts, however, are just guides because "the correct herb or spice to use is the one which tastes right," Mrs. Gifft states. The ability to decide comes with experience.

Correct amounts can't be defined either. It depends on the background and the tastes of the consumer. South Americans, for example, are very accustomed to spices that we rarely use.

So, the best rule is "season to taste but be lighthanded until you have had the experience." The charm of spices and herbs, she adds, is often their subtlety—so you can't really taste the spice when it's there but miss it when it isn't.

When to add spices during cooking depends on the dish and how long it takes the flavor of the spice or herb to come out.

The spice experts offer these general rules: "In uncooked dishes, it's better to add the flavorings early. In cooked dishes, herbs are better if added in the last half-hour of cooking. Otherwise their flavor is lost. But, spices need to be cooked much longer."

Perhaps, the whole field of spices is best summarized by Walter Duncan, founder and owner of the Finger Lakes Spice Trader, a mail order firm located in Ithaca. Mr. Duncan, a 1920 graduate of the College of Agriculture, states that "spices and herbs are the little things that make food interesting."

Even though the use of spices is increasing in this country, Mr. Duncan belives that "the American palate needs an education into the world of spices and herbs."

The advantage of spices and herbs to the modern housewife, Mr. Duncan concludes, "are their ability to put variety into meals and to make less expensive dishes seem more expensive."

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Radioactivity In Our Food

One of the atomic age's biggest hazards is radioactivity. Scientists in the Laboratory of Radiation Biology are trying to find out how radioactivity is transferred in the food chain.

by Steven A. Breth '60

RADIOACTIVE fallout is a touchy subject. It is the cause of heated debate because of its complex moral, religious, political and scientific implications. Everyone knows it can be dangerous, but no one is sure just how dangerous.

Scientists throughout the country are trying to find out exactly how radioactive fallout affects living organisms. Some of the most outstanding research is being performed here at Cornell in the Veterinary College's Laboratory of Radiation Biology.

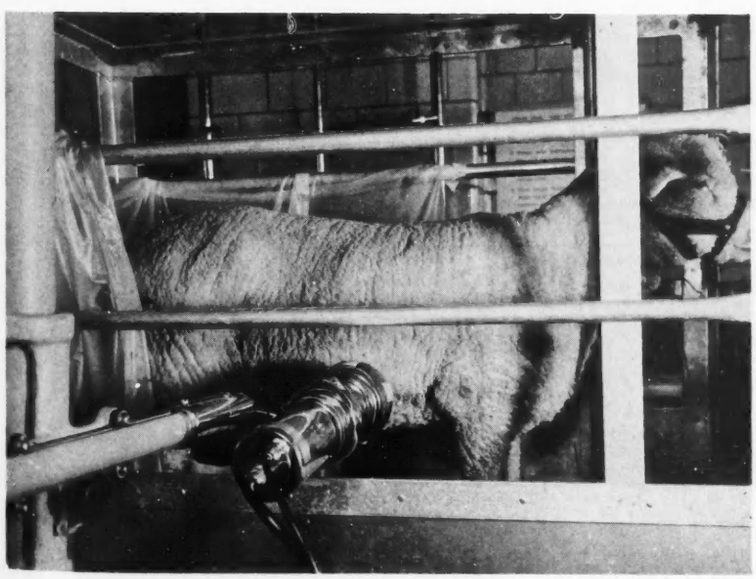
Under the direction of Dr. Cyril L. Comar, who came to Cornell by way of Oak Ridge, researchers are investigating the effects of radioactive material on the food chain, i.e. how is radioactivity transferred from the atmosphere to the soil and vegetation, from vegetation to cattle and man, and from cattle to products like meat and milk and then to man.

At the same time they are looking into the way radioactive material builds up in specific areas of an organism. For instance, iodine 131 that is ingested by an animal races to the thyroid gland and concentrates there. Radioactive calcium and strontium collect in the bone marrow, often destroying red blood corpuscles and causing leukemia.

Working under grants from the Atomic Energy Commission, Department of Defense, and U. S. Public Health Service, Dr. Comar and his staff perform experiments they hope will bring them to a closer understanding of how radioactive material is transferred and its effects on living tissue.

Because radioactivity is such a new tool, the experiments also, as a by-product, allow researchers to examine basic biological processes and to develop radioactivity, itself, as a scientific tool.

In one experiment, researchers are trying to see if a radioisotope can be trapped in the gut, keeping it from going to the bone marrow. The experiment may at the same time produce new information on the intricate problem of diffusion against a gradient.



—*C. L. Comar*

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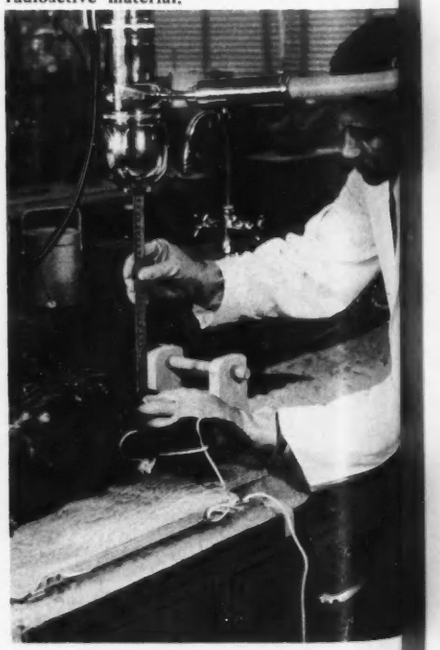
In the experiment, a laboratory rat is killed instantaneously so that its tissues will function normally when removed and put under controlled conditions. The researcher dissects out a piece of the intestine and fills it with a radioactive solution. Then the intestine is tied off and placed in a flask with a non-radioactive solution of known concentration and a constant temperature. The solutions diffuse through the intestine just as they would in a living animal.

In this way, the researcher is able to clock the rates at which different isotopes pass through the intestine wall. Similarly, he can study the differences in isotope absorption of intestines of rats that have been fed different diets.

At the same time, the peculiar way radioactive solutions move through the intestine wall is leading researchers to believe that more than just chemical processes and diffusion are involved in diffusion against a gradient. Possibly, there is a mechanical factor, too.

Cows and goats in the Radiation Laboratory, in another study, are fed capsules containing a radioactive solution. The animals live in individual chambers that catch everything they egest. The researchers analyze the animals' milk, feces, and urine for radioactive material. By knowing how much radioactive material the cows or goats were fed and how much was

A researcher checks the functioning of the liver of a dog that has been fed radioactive material.



lost in the milk and egested matter, the researcher can determine how much of a particular isotope is being retained by the animal.

The study of how radioactive material is transferred through the food chain and how different types are selectively concentrated is immensely complex. Different radioactive materials have different half lives, they are transferred from one organism to another with differing efficiency and they remain in the body for differing lengths of time.

The contrast between strontium 90 and cesium 137 exemplifies how the possible dangers of radioactive material are not simply a result of their radioactivity. Sr 90 and Cs 137 have similar half lives (30 years and 28 years, respectively). However, the maximum permissible level for lifetime exposure to Sr 90 is 80 micromicrocuries while the maximum limit for Cs 137 is 150,000 micromicrocuries. The reason: Sr 90 collects in the bone marrow and once there, it leaves the body very slowly. Every exposure to Sr 90 adds to previous exposures that are concentrated in the bone. On the other hand, Cs 137 collects in muscle and leaves the body rather rapidly. The cumulative effect of Cs 137 is much less than Sr 90.

Dr. Comar points out that although the experiments are designed to examine the effects of radioactive fallout on the food chain, they also are a means of finding new ways to use radioactivity for biological investigation.

In the last 15 years, says Dr. Comar, the physical sciences have made tremendous advances because of new techniques and greater knowledge of the atom. "In the next 15 years, using tools such as radioactive material, mass spectographs, computers, and higher mathematics, the biological sciences will have a new awakening."

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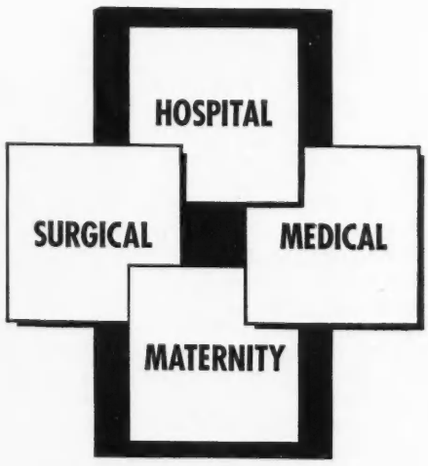

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Regeneration In Frogs, Salamanders, and Humans

Dr. Marcus Singer has found that a product of the nerves may be the answer to limb regeneration in animals.

by Tina Bloomstein '63

WHY is it that the leg of a salamander regenerates after amputation and the leg of a man does not? What is it about the metabolism of a salamander which allows it to regenerate? These questions intrigue many scientists, among them Cornell's Dr. Marcus Singer, of the department of zoology. He has been working on the problems of regeneration for many years.

The work has many important implications. In a few years, for instance, it may be possible for humans to regenerate limbs lost in accidents or internal organs lost by disease. In addition, Dr. Singer's work demonstrates that even a fully formed adult carries on developmental processes usually associated only with an embryo. The cells of an embryo differentiate into specialized organs such as the heart, lungs, brains, and circulatory system. When you cut off the leg of a salmander, the remaining cells return to the embryonic state. Then they differentiate into specialized cells, reforming the leg.

The hunt for the cause of regeneration has ben carried on for many years by Dr. Singer and his associates. There have been many theories which have attempted to explain the reason for the return of cells to an embryonic state. For one reason or another, however, each one had to be rejected. The best clue comes from the role played by the nerves in regenerating tissue.

In a series of experiments Dr. Singer verified data collected as early as 1823 by an English researcher, Tweedy John Todd. Todd's work showed that an amputated leg will not regenerate if its nerves are paralyzed by the amputation. If, however, the nerves are not paralyzed, the limb will grow again.

The exact way a nerve affects a regenerating limb is not known, yet. At one point a chemical, acetylcholine, produced by nerves was thought to be important in regeneration.

In order to test whether acetylcholine was the agent which enabled an organism to regenerate, Dr. Singer developed a device which can test the effect of several chemical substances on regenerating tissue. It consists of a hollow glass needed which is placed in the tissue of the animal. This needle is connected to a polyethylene tube through which drug solutions are passed. The rate of flow is regulated by a plunger in a syringe that is connected to the polyethelene tube.

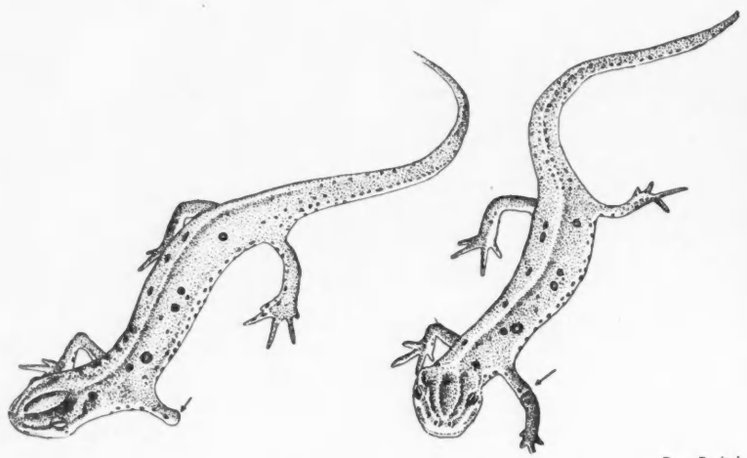
The experiment to test the effect of acetylcholine involved the use of another chemical called atropine. Atropine is known to block the effect of acetylcholine. Thus, if a new limb was growing and it suddenly stopped when atropine was induced, it could the be logically concluded that the growth stopped because acetylcholine no longer had an effect.

When the experiment was actually performed the atropine stopped growth for several days after which growth of the regenerate resumed.

The halting of growth by atropine is particularly dramatic because the regenerate is insensitive to biologically destructive agents such as distilled water, a strong salt solution, and high and low pH.

Atropine's effect, according to Dr. Singer, may be due to poisoning the cells of regeneration or the nerve fibers themselves. However, when acetylcholine, itself, was infused with atropine, the atropine no longer retarded growth.

Additional experiments performed by Dr. Singer showed that acetylcholine was present in large quantities throughout regeneration. However, Dr. Singer notes that "it is important to emphasize that the period of rise in amount of acetylcholine coincides rather precisely with the time when the effect of



—*Ray Poritsky*

Left, salamander with fore leg amputated (arrow). Right, the salamander has regenerated most of his fore leg. Arrow indicates point at which growth started. Regeneration is normal in the salamander.

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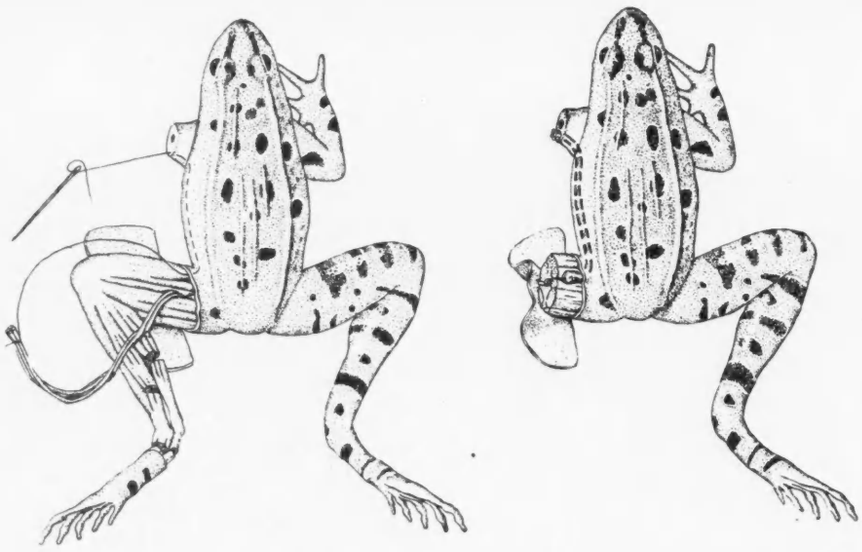

—*Ray Poritsky*

Nerves from the hind leg of a frog (left) are attached to the fore leg (right) causing it to regenerate.

the nerve upon the growth of the regenerate is most effective. It then decreases in quantity at a time which corresponds to the decline in importance of the nerve in regeneration."

In spite of all the evidence which points to acetylcholine as the agent which promotes regeneration, Dr. Singer believes that acetylcholine cannot be the answer to the regeneration problem.

If acetylcholine were the agent causing regeneration then it should cause nerveless regenerate tissue to continue growing. Dr. Singer tested this by introducting acetylcholine in several ways, none of which produced growth.

Another series of experiments performed by Dr. Singer also rule out acetylcholine. He found that even when a limb had enough acetylcholine to cause it to regenerate, i.e. as much acetylcholine as limbs actively regenerating, there were instances where regeneration did not occur. If acetylcholine was responsible for regenerate growth, then there would be a direct relationship between the amount found in a limb and the regenerative capacity which the limb shows.

Dr. Singer has found that "no correlation can be drawn between acetylcholine content and regenerative capacity. . . The only correlation that can be drawn between these various states of innervation and regenerative capacity is that regeneration occurs when threshhold requirements in nerve number are met."

This is substantiated by an experiment with mature frogs. The adult frog does not normally regenerate limbs. But, Dr. Singer discovered that adult frogs can regenerate limbs if he supplied the tissue with an above normal number of nerve cells.

When asked why atropine could suppress regeneration, even though acetylcholine is not responsible for regeneration, Dr. Singer replied that atropine may have destroyed another chemical that is responsible for regenerative growth, it may have altered the physiology of the nerve itself, or it may have harmed the cells of regeneration which then recovered.

In any case, Dr. Singer's conclusion was that "if . . . a chemical emanation from the nerve fiber is the agent of the removal influence upon growth, the chemical substance is not acetylcholine itself." Work is still going on in an attempt to find the chemical which influences an animal's capacity to regenerate.

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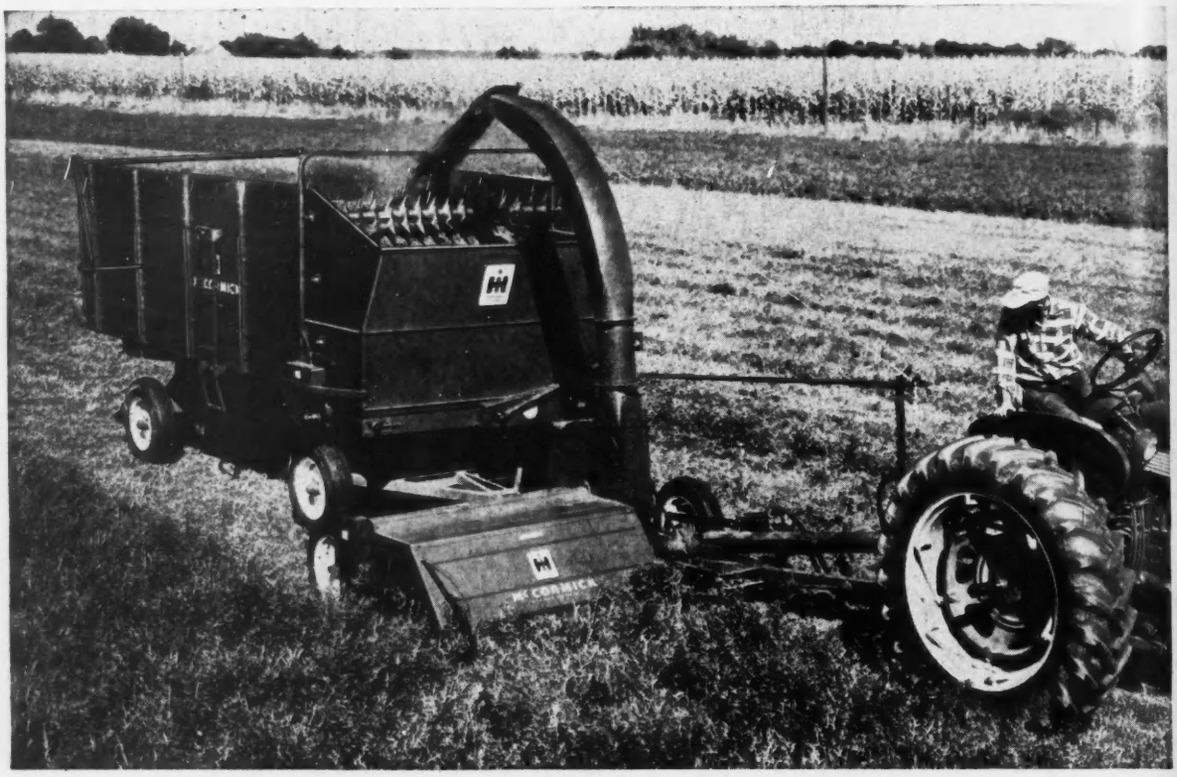

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